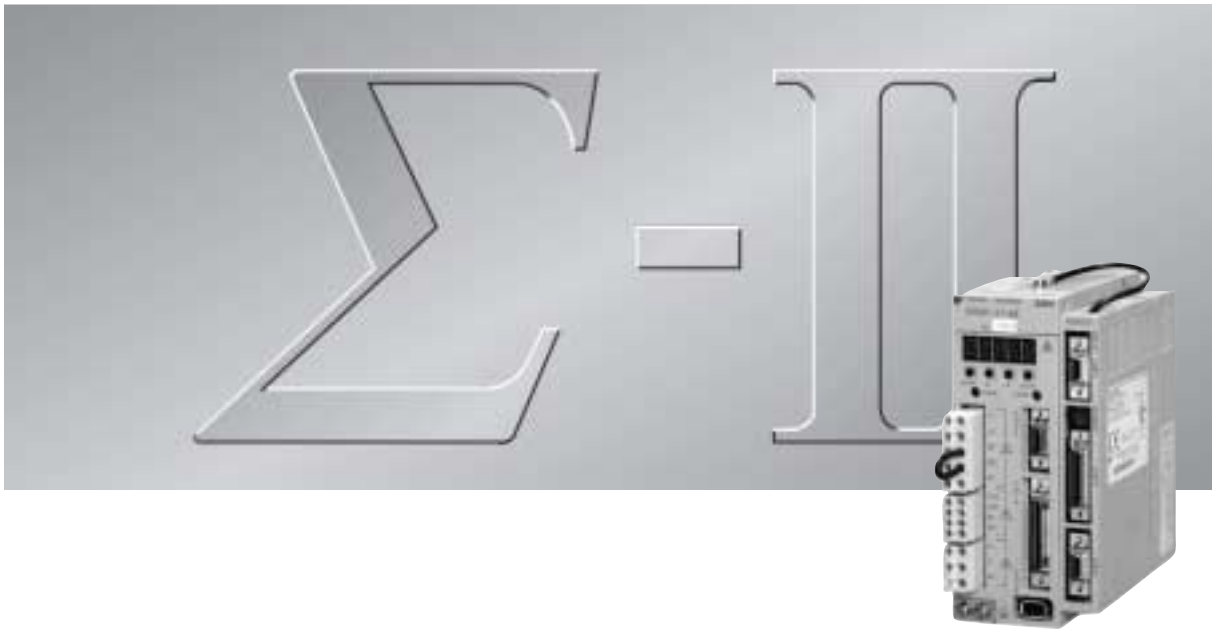
Σ-Ⅱ Series SGDH

Indexer Application Module

USER'S MANUAL

MODEL: JUSP-NS600



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Overview

■ About this Manual

This manual provides the following information for a Σ-II Series SGM□H/SGDH Servodrive that has an Indexer Application Module installed. (The Indexer Application Module is referred to as the "NS600" in the remainder of this manual.)

- Procedures for installing and wiring the NS600
- Procedures for trial operation of the NS600
- Procedures and specifications for serial communications
- Procedures for using the Hand-held Digital Operator
- Procedures for setting parameters and the program table
- Procedures for using digital I/O signals
- Procedures for troubleshooting

■ Intended Audience

This manual is intended for the following users.

- Those designing Σ-II Series Servodrive systems
- Those installing or wiring Σ-II Series Servodrives
- Those performing trial operation or adjustments of Σ-II Series Servodrives
- Those maintaining or inspecting Σ-II Series Servodrives

■ Description of Technical Terms

In this manual, the following terms are defined as follows:

- NS600 = JUSP-NS600
- Servomotor = Σ-II Series SGMAH, SGMPH, SGMGH, or SGMSH servomotor
- SERVOPACK = Σ-II Series SGDH SERVOPACK
- Servodrive = A set including a servomotor and Servo Amplifier
- Servo System =A servo control system that includes the combination of a Servodrive with a host computer and peripheral devices

■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following examples:

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{RGRT}}$ = /RGRT

■ Indication of Dual Purpose Input Signals

Some terminals have different functions (input different signals) depending on the mode set with the /MODE 0/1 signal. The two input signal names are separated by a semi-colon with the Mode 0 signal name on the left and the Mode 1 signal name on the right.

- Example: $\overline{\text{START-STOP}}$; $\overline{\text{HOME}}$ = /START-STOP; /HOME

In the example above, the input signal is /START-STOP in Mode 0 or /HOME in Mode 1.

■ Visual Aids

The following aids are used to indicate certain types of information for easier reference.

IMPORTANT — Indicates important information that should be memorized, including precautions such as alarm displays to avoid damaging the devices.

Indicates supplemental information.

◀ EXAMPLE ▶ — Indicates application examples.

Indicates definitions of difficult terms or terms that have not been previously explained in this manual.

Related Manuals

Refer to the following manuals as required.

Read this manual carefully to ensure the proper use of Σ-II Series Servodrives. Also, keep this manual in a safe place so that it can be referred to whenever necessary.

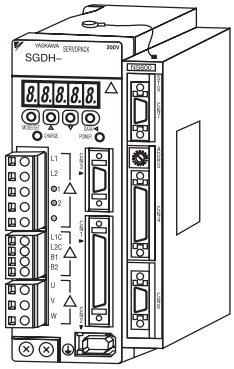
Manual Name	Manual Number	Contents
Σ-II Series SGM□H/SGDH User's Manual Servo Selection and Data Sheets	SIE-S800-32.1	Describes the procedure used to select Σ-II Series Servodrives and capacities.
Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance	SIE-S800-32.2	Provides detailed information on the installation, wiring, trial operation, functions, maintenance, and inspection of Σ-II Series Servodrivers.

Product Overview

The NS600 Indexer Application Module is a single-axis positioning device that is equipped with a registration function and connects to the SGDH SERVOPACK through Dual-port RAM.

The NS600/SERVOPACK combination enhances the SERVOPACK's functions and allows easy positioning between two points along with the registration function.

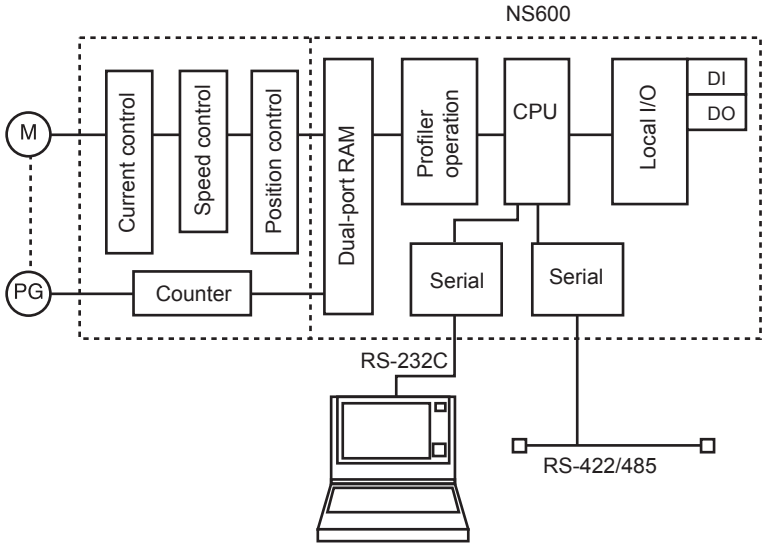
The NS600 has two reference methods: serial commands and digital I/O.
With serial commands, ASCII command strings are sent to the NS600 through RS-232C, RS-422, or RS-485 wiring and these commands are interpreted and executed immediately. Digital I/O is structured as a program table (Mode 0) or jog speed table (Mode 1). If the program table (Mode 0) is being used, the program step selected with the input signal pattern (binary format) can be executed. If the jog speed table (Mode 1) is being used, the jog speed selected with the input signal pattern (binary format) can be executed.



Σ-II Series SGDH SERVOPACK
(with NS600 installed)

NS600 Functions

Function	Description
Digital I/O program table (Mode 0)	The program step selection input signals (binary format) are used to select the desired positioning data from the program table stored in the NS600. The NS600 can store up to 128 program steps. The program steps can be linked to create combinations that perform more complex motions.
Digital I/O jog speed table (Mode 1)	Up to 16 jog speed levels can be set. The jog speed selection input signals (binary format) are used to select the desired jog speed.
Serial commands	Positioning is controlled by ASCII command strings received through RS-232C, RS-422, or RS-485 wiring. Up to 16 axes can be connected. It is also possible to use the ASCII serial commands to select positioning data from the program table stored in the NS600.
Registration	Both serial commands and program table are equipped with registration functions (external positioning).
Programmable output signals	There are 5 output signals (/POUT0 to /POUT4) that can be programmed.
Zone signals and zone table	The programmable output signals (/POUT0 to /POUT4) can also be used as zone signals. Up to 32 zones can be specified in the zone table.
Homing	Homing can be used for zero-point return when an incremental encoder is being used. There are three variations of the homing function: • Using the deceleration limit switch and encoder's phase C • Using the deceleration limit switch only • Using the encoder's phase C only



Block Diagram

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ WARNING — Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

⚠ CAUTION — Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

⃠ PROHIBITED — Indicates actions that must never be taken.

Safety Precautions

The following precautions are for checking products upon delivery, installation, wiring, operation, maintenance and inspections.

■ Checking Products upon Delivery

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.

  Not doing so may cause fire or malfunction.

■ Installation

⚠ CAUTION

- Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.

  Doing so may result in electric shock or fire.

■ Wiring

⚠ WARNING

- Connect the ground terminal to electrical codes (ground resistance: 100 Ω or less).

  Improper grounding may result in electric shock or fire.

⚠ CAUTION

- Do not connect a three-phase power supply to the SERVOPACK's U, V, or W output terminals.

  Doing so may result in injury or fire.
- Securely fasten the power supply terminal screws and motor output terminal screws.

  Not doing so may result in fire.

■ Operation

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.

  Doing so may result in injury.

⚠ CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.

  Not doing so may result in injury.
- Before starting operation with a machine connected, change the settings to match the parameters of the machine.

  Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.

  Not doing so may result in injury.
- Do not touch the heat sinks during operation.

  Doing so may result in burns due to high temperatures.

■ Maintenance and Inspection

⚠ WARNING

- Never touch the inside of the SERVOPACKs.

  Doing so may result in electric shock.
- Do not remove the panel cover while the power is ON.

  Doing so may result in electric shock.
- Do not touch terminals for five minutes after the power is turned OFF.

  Residual voltage may cause electric shock.

⚠ CAUTION

- Do not disassemble the servomotor.

  Doing so may result in electric shock or injury.
- Do not attempt to change wiring while the power is ON.

  Doing so may result in electric shock or injury.

■ General Precautions

Note the following to ensure safe application.

- The drawings presented in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. The edition number appears on the front and back covers.
- If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.
- Yaskawa will not take responsibility for the results of unauthorized modifications of this product. Yaskawa shall not be liable for any damages or troubles resulting from unauthorized modification.

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Checking Products and Part Names

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1.1 Checking Products on Delivery

The following procedure is used to check the NS600 upon delivery. Check the following items when the NS600 is delivered.

Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model number marked on the NS600's nameplate. (Refer to the descriptions of model numbers on following pages)
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Can the SERVOPACK be used with the NS600?	Check the model number marked on the SERVOPACK's nameplate. SERVOPACK model number: SGDH-□□□E-□ (1) (2) 1) First part must be "SGDH". 2) Middle part must end with an "E".

If any of the above items are faulty or incorrect, contact your Yaskawa sales representative or the dealer from whom you purchased the products.

1.1.1 External Appearance and Nameplate Examples

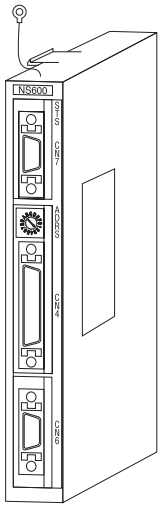


Fig. 1.1 External Appearance of the NS600

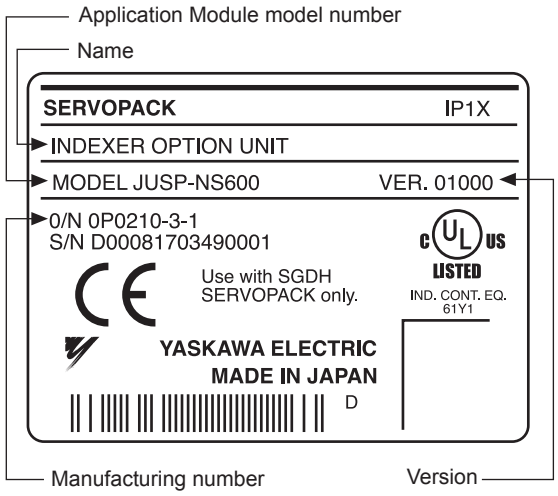
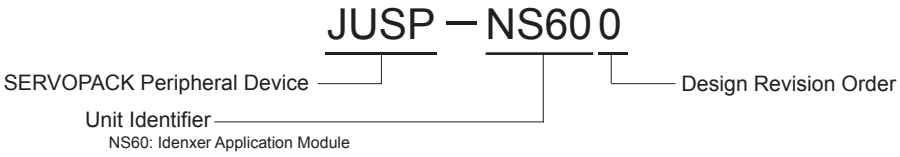


Fig. 1.2 Example Nameplate

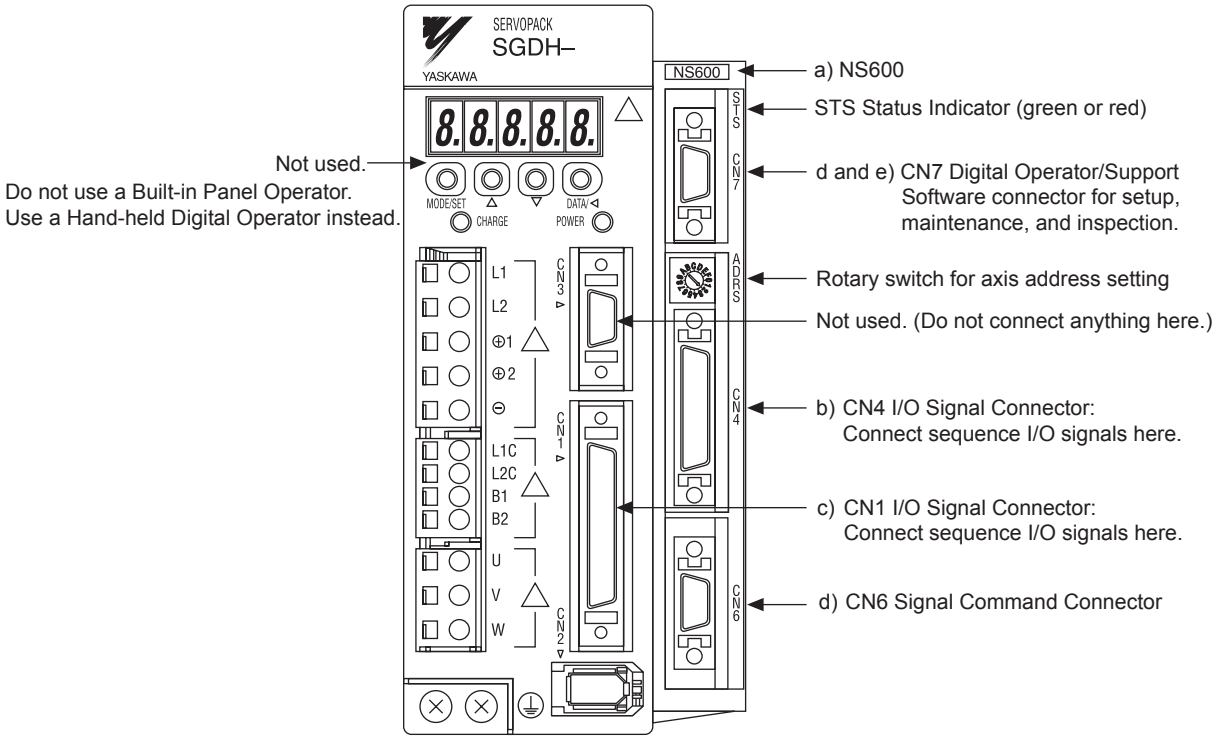
1.1.2 Model Number

NS600



1.2 Product Part Names

The figure below shows the part names of a SERVOPACK that has the NS600 installed.



Note: Refer to Table1.1 below for details on components a through e.

Table 1.1 Model Numbers

Component			Model Number
Indexer	a	NS600	JUSP-NS600
I/O Cables	b	CN4 I/O Cable (loose wires on other end), 36 pins, 1.0 m	DE9404859
		CN4 I/O Cable (loose wires on other end), 36 pins, 2.0 m	DE9404859-2
		CN4 I/O Cable (loose wires on other end), 36 pins, 3.0 m	DE9404859-3
		CN4 I/O Cable (terminal block on other end), 36 pins, 0.5 m	JUSP-TA36P
	c	CN1 I/O Cable (terminal block on other end), 50 pins, 1.0 m	JZSP-CKI01-1
		CN1 I/O Cable (terminal block on other end), 50 pins, 2.0 m	JZSP-CKI01-2
		CN1 I/O Cable (terminal block on other end), 50 pins, 3.0 m	JZSP-CKI01-3
		CN1 I/O Cable (terminal block on other end), 50 pins, 0.5 m	JUSP-TA50P
Serial Communi-cations Cables	d	CN6 Cable for RS-422 or RS-485 connections	(Prepared by user.)
		CN6 Cable for personal computer connection (RS-232C Cable with 9-pin D-SUB connector), 2.0 m	JZSP-CMS02
		CN7 Cable for RS-422 connection	(Prepared by user.)
		CN7 Cable for personal computer connection (RS-232C Cable with 9-pin D-SUB connector), 2.0 m	JZSP-CMS02

Table 1.1 Model Numbers (cont'd)

Component			Model Number
Accessories	b	CN4 Connector (with case), 36 pins	DP9420007
	c	CN1 Connector (with case), 50 pins	JZSP-CK19
Digital Operators	e	Digital Operator (with 1-m cable)	JUSP-OP02A-2
		Digital Operator Cable (1 m)	JZSP-CMS00-1
		Digital Operator Cable (1.5 m)	JZSP-CMS00-2
		Digital Operator Cable (2 m)	JZSP-CMS00-3
Support Software		Sigma Indexer (Japanese-language version)	JZSP-SGNS600J
		Sigma Indexer (English-language version)	JZSP-SGNS600E

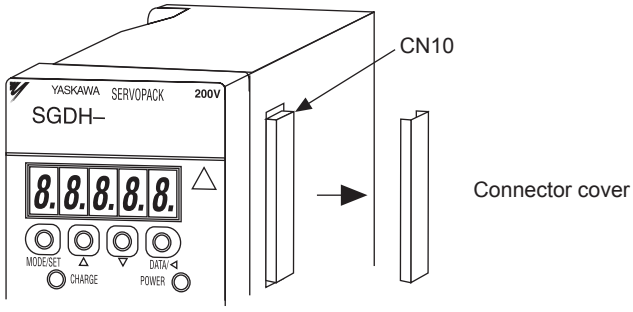
Note: Refer to the Σ-*II Series SGM□H/SGDH User's Manual Servo Selection and Data Sheets* (Manual No.: SIE-S800-32.1) for part numbers and additional information on servomotors, SERVOPACKs, power supply cables, encoder cables, and other accessories.

1.3 Installing the Application Module

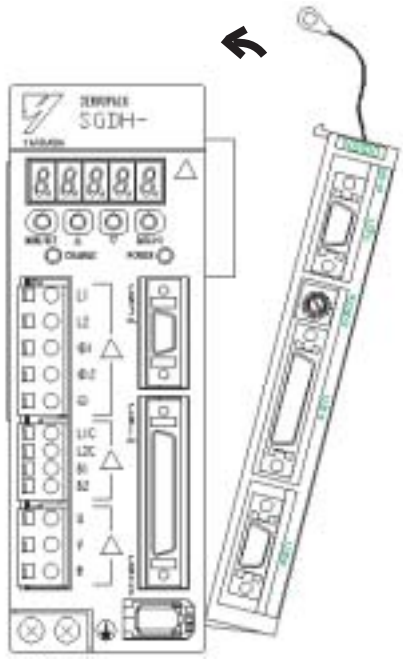
Use the following procedure to mount an NS600 to an SGDH SERVOPACK. A screw is needed to connect the ground wire; use the screw listed in the following table.

SERVOPACK Model	Screw	Comments
SGDH-A3 to 02BE SGDH-A3 to 10AE	M3×10 round head screw (with split lock and plain washers)	Attachments
SGDH-15 to 50AE SGDH-05 to 50DE	M4×10 round head screw (with split lock and plain washers)	Attachments
SGDH-60 to 1EAE SGDH-60 to 1EDE	M4×8 round head screw (with split lock and plain washers)	Use the screw on the front panel.
SGDH-A3 to 02BE-R SGDH-A3 to 50AE-R SGDH-05 to 50DE-R (Rack-mounting models)	M4×6 round head screw (with split lock and plain washers)	Attachments

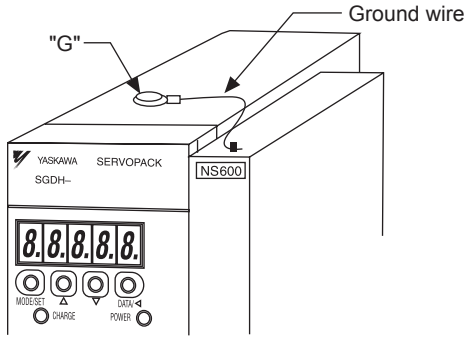
1. Remove the connector cover attached to the SERVOPACK's CN10 Connector.



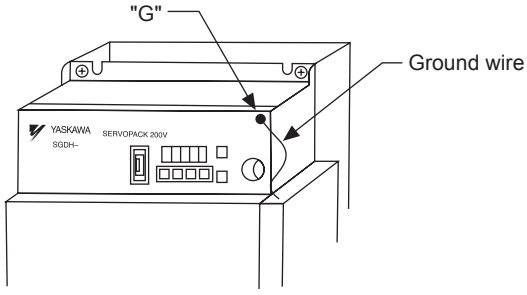
2. Insert the two tabs on the bottom of the NS600 into the holes on the lower-right side of the SERVOPACK.



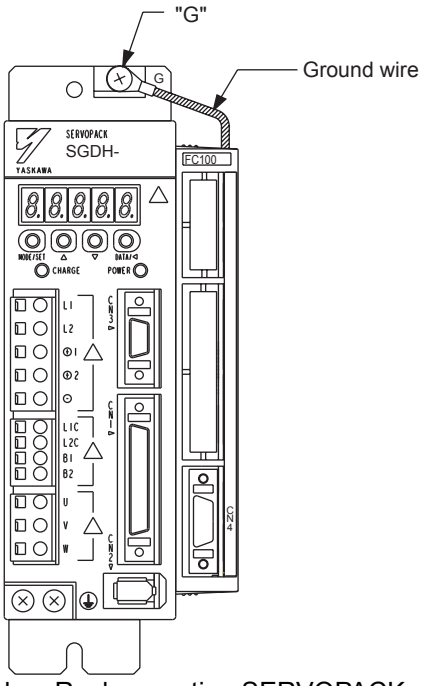
3. Push the NS600 until the two tabs on the top of the NS600 are fully inserted into the two holes on the upper-right side of the SERVOPACK, as shown in the diagram above.
4. Connect the NS600's ground wire to the SERVOPACK's "G" terminal and tighten the screw.



Ground on 30-W to 50-kW SERVOPACKs

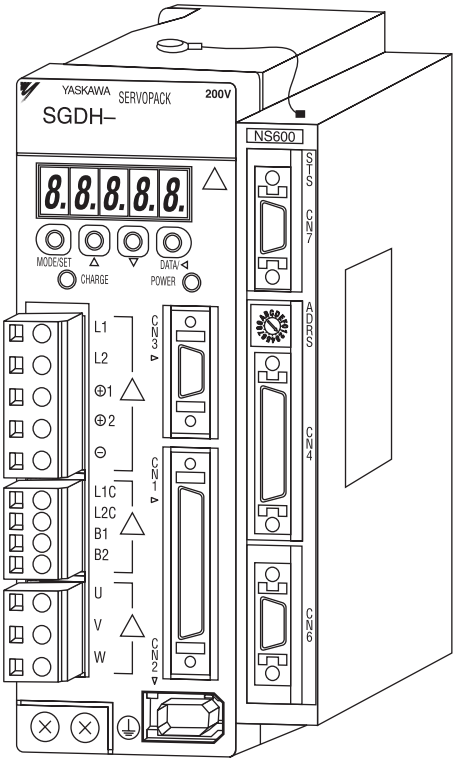


Ground on 6.0-kW to 15-kW SERVOPACKs



Ground on Rack-mounting SERVOPACKs

The following diagram shows a SERVOPACK with an NS600 installed correctly.



2

Installation

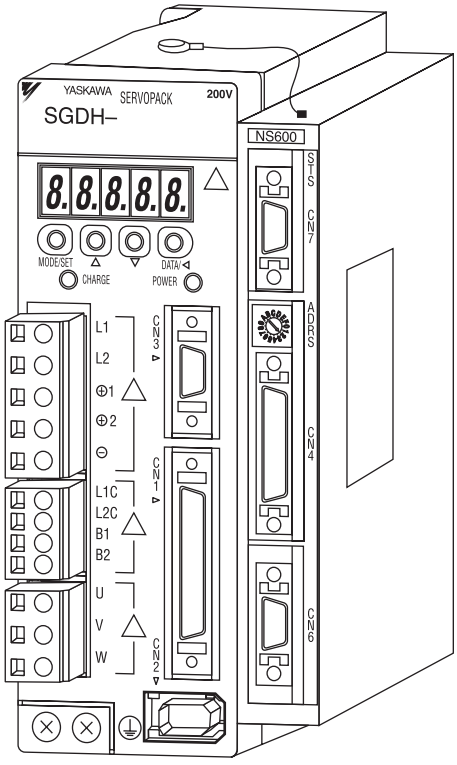
This chapter describes precautions for Σ-II Series installation.
The SGDH SERVOPACKs are base-mounted servoamps. Incorrect installation will cause problems. Always observe the installation instructions described in this chapter.

2.1 Storage Conditions ----------2-2
2.2 Installation Site ----------2-3
2.3 Orientation ----------2-4
2.4 Installation ----------2-5

2.1 Storage Conditions

Store the SERVOPACK within the following temperature range if it is stored with the power cable disconnected.

Temperature Range: –20 to 85°C



Σ-II Series SGDH SERVOPACK
(with NS600 installed)

2.2 Installation Site

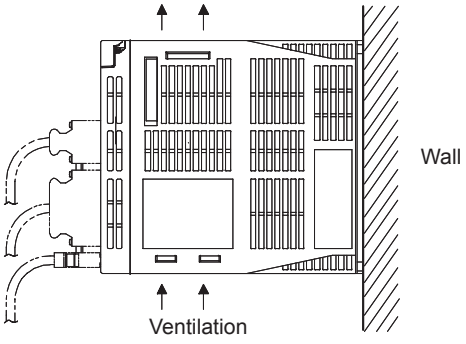
Take the following precautions at the installation site.

Situation	Installation Precaution
Installation in a Control Panel	Design the control panel size, unit layout, and cooling method so the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Heating Unit	Minimize heat radiated from the heating unit as well as any temperature rise caused by natural convection so the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Source of Vibration	Install a vibration isolator beneath the SERVOPACK to avoid subjecting it to vibration.
Installation at a Site Exposed to Corrosive Gas	Corrosive gas does not have an immediate effect on the SERVOPACK, but will eventually cause electronic components and contactor-related devices to malfunction. Take appropriate action to avoid corrosive gas.
Other Situations	Do not install the SERVOPACK in hot and humid locations or locations subject to excessive dust or iron powder in the air.

2.3 Orientation

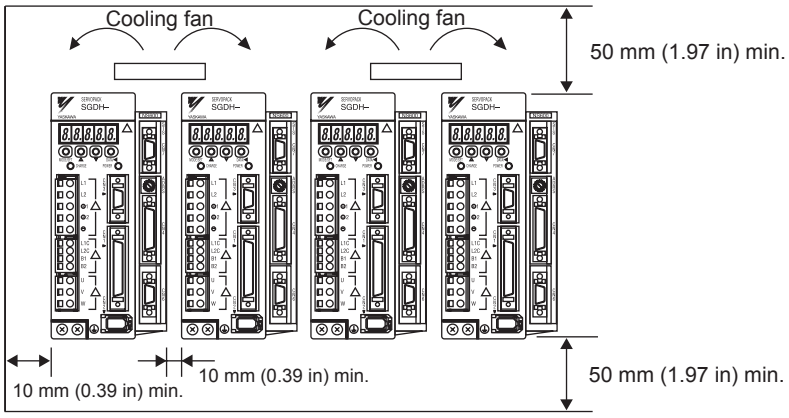
Install the SERVOPACK perpendicular to the wall as shown in the figure. The SERVOPACK must be oriented this way because it is designed to be cooled by natural convection or cooling fan.

Secure the SERVOPACK using 2 to 4 mounting holes. The number of holes depends on the capacity.



2.4 Installation

Use the following layout (side-by-side installation) when installing two or more SERVOPACKs side by side in a control panel.



■ SERVOPACK Orientation

Install the SERVOPACK perpendicular to the wall so the front panel containing connectors faces outward toward the user.

■ Cooling

As shown in the figure above, allow sufficient space around each SERVOPACK for cooling by cooling fans or natural convection.

■ Side-by-side Installation

When installing SERVOPACKs side-by-side as shown in the figure above, allow at least 10 mm (0.39 in) between and at least 50 mm (1.97 in) above and below each SERVOPACK. Install cooling fans above the SERVOPACKs to avoid excessive temperature rise and to maintain even temperature inside the control panel.

■ Environmental Conditions in the Control Panel

- Ambient Temperature: 0 to 55°C
- Humidity: 90% or less
- Vibration: 4.9 m/s^2
- Condensation and Freezing: None
- Ambient Temperature for Long-term Reliability: 45°C max.

3

Connector Wiring

This chapter explains how to connect to the connectors of an SGDH SERVOPACK with an NS600 installed.

3.1 I/O Signal Connections - 3-2
3.1.1 Examples of I/O Signal Connections to CN1 and CN4 - - - - - - - - - - - - 3-2
3.1.2 Terminal Layout on I/O Signal Connectors CN1 and CN4 - - - - - - - - - 3-4
3.1.3 I/O Signal Names and Functions - 3-6
3.1.4 Interface Circuits - 3-8
3.2 Serial Command Communications Connector (CN6) - - - - - 3-10
3.2.1 Communications Specifications - 3-10
3.2.2 Communications Connector - 3-11
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3.2.5 RS-422/RS-485 Interface - 3-14
3.3 Digital Operator or Support Software Connector (CN7) - - - - 3-15
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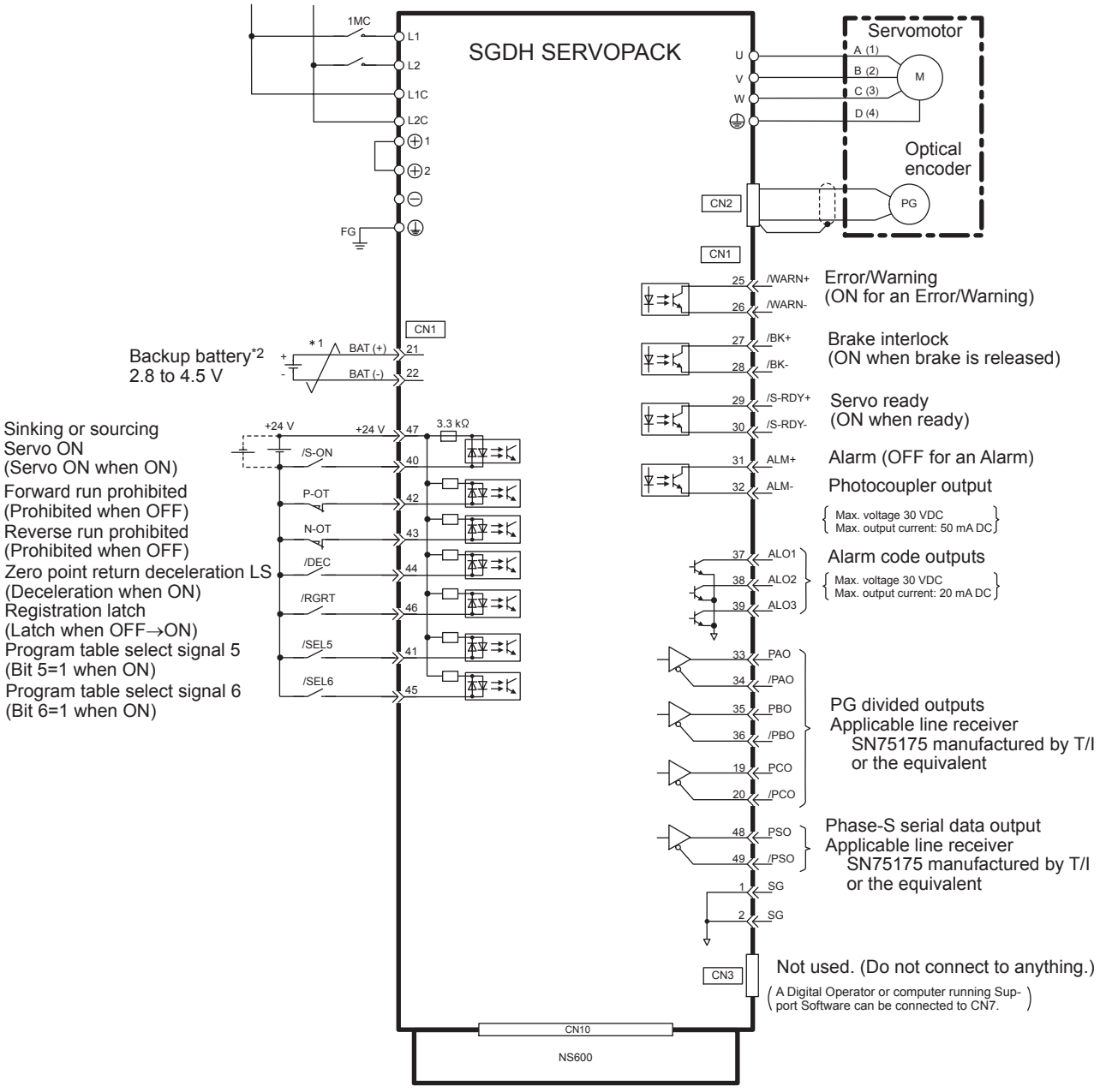
3.1 I/O Signal Connections

This section describes I/O signal connections for an SGDH SERVOPACK with an NS600 installed.

3.1.1 Examples of I/O Signal Connections to CN1 and CN4

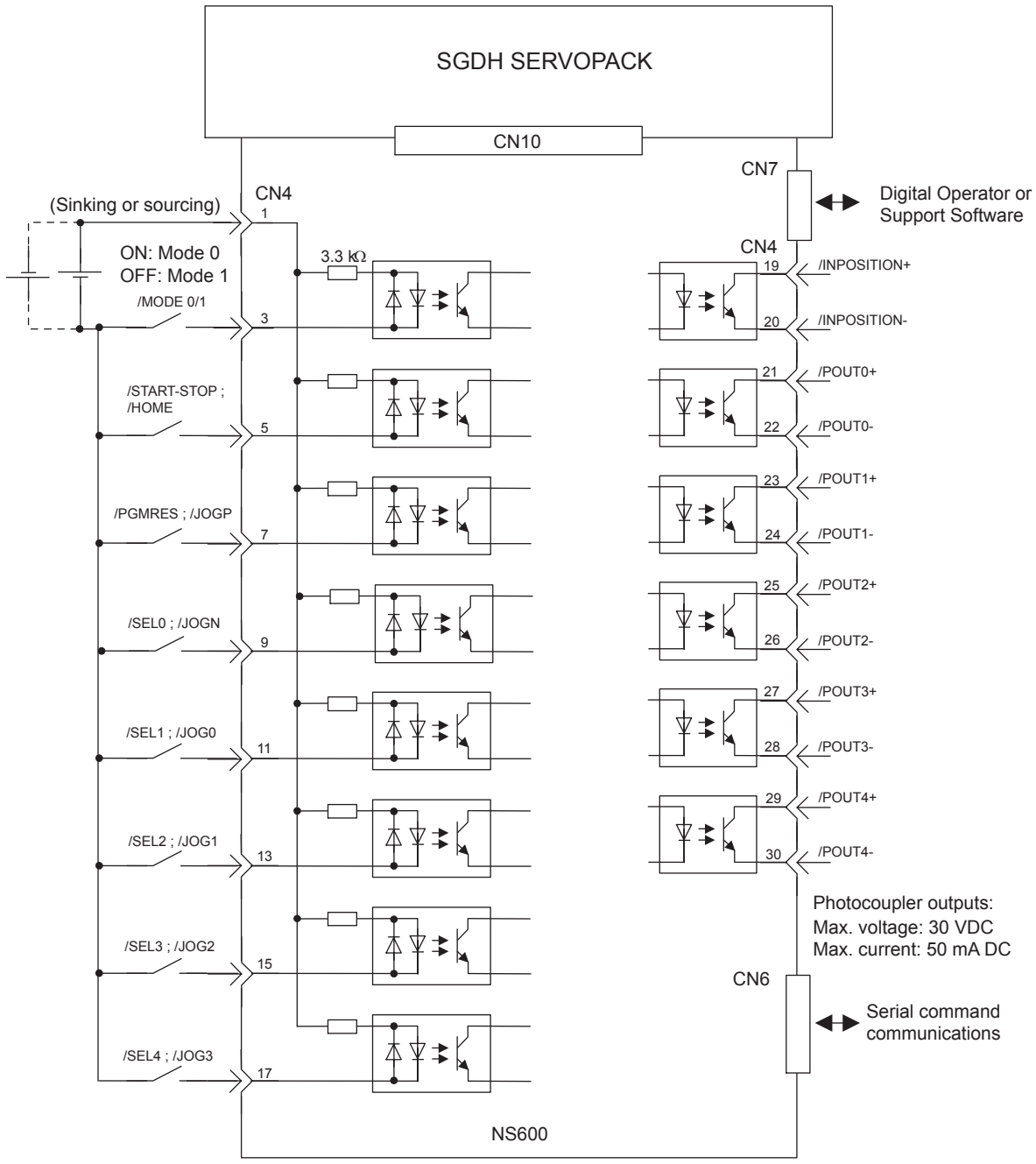
The following diagram shows a typical example of I/O signal connections.



* 1. ⌒ represents twisted-pair wires.

* 2. Connect only when an absolute encoder is being used and a battery is not connected to CN8.

Fig. 3.1 Example Connections to I/O Signal Connector CN1



Note: When two signal names are listed, the first set of signals (/START-STOP, /PGMRES, /SEL0, /SEL1, /SEL2, /SEL3, and /SEL4.) is valid when Mode 0 is set. The second set of signals (/HOME, /JOGP, /JOGN, /JOG0, /JOG1, /JOG2, and /JOG3) is valid when Mode 1 is set.

Fig. 3.2 Example Connections to I/O Signal Connector CN4

3.1.2 Terminal Layout on I/O Signal Connectors CN1 and CN4

The following diagrams show the layout and specifications of CN1 and CN4 terminals.

■ CN1 Terminal Layout

			1	SG	GND				26	/WARN-	Servo warning output
2	SG	GND				27	/BK+	Brake interlock output			
			3	-	-				28	/BK-	Brake interlock output
4	-	-				29	/S-RDY+	Servo ready output			
			5	-	-				30	/S-RDY-	Servo ready output
6	SG	GND				31	ALM+	Alarm output			
			7	-	-				32	ALM-	Servo alarm output
8	-	-				33	PAO	PG divided output phase A			
			9	-	-				34	/PAO	PG divided output phase A
10	SG	GND				35	PBO	PG divided output phase B			
			11	-	-				36	/PBO	PG divided output phase B
12	-	-				37	ALO1	Alarm code outputs			
			13	-	-				38	ALO2	Alarm code output
14	-	-				39	ALO3				
			15	-	-				40	/S-ON	Servo ON input
16	-	-				41	/SEL5	Program table select signal 5			
			17	-	-				42	P-OT	Forward overtravel input
18	-	-				43	N-OT	Reverse overtravel input			
			19	PCO	PG divided output phase C				44	/DEC	Zero point return deceleration LS input
20	/PCO	PG divided output phase C				45	/SEL6	Program table select signal 6			
			21	BAT (+)	Battery (+)				46	/RGRT	Registration latch
22	BAT (-)	Battery (-)				47	+24VIN	Power supply for sequence signals			
			23	-	-				48	PSO	Phase-S output
24	-	-				49	/PSO	Phase-S output			
			25	/WARN+	Error/Warning output				50	-	-

Note: 1. Do not use unused terminals for relays.
2. Connect the shield of the I/O signal cable to the connector shell.
Connect to the FG (frame ground) at the SERVOPACK-end connector.

■ CN1 Specifications

Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Solder Type	Case	Manufacturer
10250-52A2JL or Equivalent 50-p Right Angle Plug	10150-3000VE	10350-52A0-008	Sumitomo 3M Co.

■ CN4 Terminal Layout

1	24V/COM	Power supply for sequence signals	2	-	-	19	/INPOSITION+	Positioning complete output	20	/INPOSITION-	Positioning complete output
3	/MODE0/1	Mode select input	4	-	-	21	/POUT0+	Programmable output 0	22	/POUT0-	Programmable output 0
5	/START-STOP; /HOME	Start-Stop/ Homing start	6	-	-	23	/POUT1+	Programmable output 1	24	/POUT1-	Programmable output 1
7	/PGMRES; /JOGP	Program reset/ JOG Forward input	8	-	-	25	/POUT2+	Programmable output 2	26	/POUT2-	Programmable output 2
9	/SEL0; /JOGN	Program select 0/JOG Reverse input	10	-	-	27	/POUT3+	Programmable output 3	28	/POUT3-	Programmable output 3
11	/SEL1; /JOG0	Program select 1/JOG Select 0 input	12	-	-	29	/POUT4+	Programmable output 4	30	/POUT4-	Programmable output 4
13	/SEL2; /JOG1	Program select 2/JOG Select 1 input	14	-	-	31	-	-	32	-	-
15	/SEL3; /JOG2	Program select 3/JOG Select 2 input	16	-	-	33	-	-	34	-	-
17	/SEL4; /JOG3	Program select 4/JOG Select 3 input	18	-	-	35	-	-	36	-	-

■ CN4 Specifications

Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Solder Type	Case	Manufacturer
10236-52A2JL or Equivalent 36-p Right Angle Plug	10136-3000VE	10336-52A0-008	Sumitomo 3M Co.

3.1.3 I/O Signal Names and Functions

The following tables describe SERVOPACK I/O signal names and functions.

■ CN1 Input Signals

Signal Name		Pin No.	Function	
Common	/S-ON	40	Servo ON: When ON, power is supplied to the motor. When OFF, power is not supplied to the motor.	
	P-OT N-OT	42 43	Forward Run prohibited Reverse Run prohibited	Overtravel prohibited: Stops servomotor when movable part travels beyond the allowable range of motion.
	/DEC	44	Zero Point Return Deceleration Limit Switch: Connects to the deceleration limit switch for homing.	
	/RGRT	46	Registration Latch: This is a latch signal used for registration (external positioning).	
	+24VIN	47	Power Supply for Sequence Signals: Voltage range: 11 V to 25 V	
	BAT(+) BAT(-)	21 22	These pins can be used to connect an absolute encoder's backup battery. Connect to CN8 or pins 21 and 22 of CN1.	
	/SEL5	41	When Mode 0 has been set, this pin functions as Program Table Select 5.	
	/SEL6	45	When Mode 0 has been set, this pin functions as Program Table Select 6.	

■ CN1 Output Signals

Signal Name		Pin No.	Function
Common	ALM+ ALM-	31 32	Servo Alarm: Turns OFF when an error is detected.
	/WARN+ /WARN-	25 26	Error/Warning: ON for 2 seconds when an error has occurred. ON continuously while a warning is being detected.
	/BK+ /BK-	27 28	Brake interlock (controls the brake): ON when the brake is released.
	/S-RDY+ /S-RDY-	29 30	Servo Ready: ON when the control and main circuit power supplies are ON and a Servo Alarm has not occurred.
	ALO1 ALO2 ALO3	37 38 39 (1)	Alarm Code: Outputs 3-bit alarm codes. Open-collector: 30 V and 20 mA rating maximum.
	FG	Shell	Frame ground

Note: The pin number in parentheses indicates the signal ground.

■ CN4 Input Signals

Signal Name	Pin No.	Function
+24V/COM	1	Power Supply for Sequence Signals. Voltage range: 11 V to 25 V
/MODE 0/1	3	This pin switches between Mode 0 and Mode 1. ON: Mode 0 (Program table operation) OFF: Mode 1 (JOG speed table operation or homing)
/START-STOP; /HOME	5	Mode 0: When ON, starts or restarts program table operation. Refers to signals /SEL0 through /SEL6 when starting operation. When OFF, interrupts program table operation. Mode 1: When ON, starts or restarts homing. When OFF, interrupts homing.
/PGMRES; /JOGP	7	Mode 0: When ON while program table operation is interrupted, resets program table operation. Mode 1: When ON, causes forward JOG operation. When OFF, stops forward JOG operation.
/SEL0;/JOGN	9	Mode 0: Program table 0 Mode 1: When ON, causes reverse JOG operation. When OFF, stops reverse JOG operation.
/SEL1;/JOG0	11	Mode 0: Program table selector 1 Mode 1: JOG speed table selector 0
/SEL2;/JOG1	13	Mode 0: Program table selector 2 Mode 1: JOG speed table selector 1
/SEL3;/JOG2	15	Mode 0: Program table selector 3 Mode 1: JOG speed table selector 2
/SEL4;/JOG3	17	Mode 0: Program table selector 4 Mode 1: JOG speed table selector 3

■ CN4 Output Signals

Signal Name	Pin No.	Function
/INPOSITION+	19	Positioning complete
/INPOSITION-	20	
/POUT0+	21	Programmable outputs
/POUT0-	22	
/POUT1+	23	
/POUT1-	24	
/POUT2+	25	
/POUT2-	26	
/POUT3+	27	
/POUT3-	28	
/POUT4+	29	
/POUT4-	30	

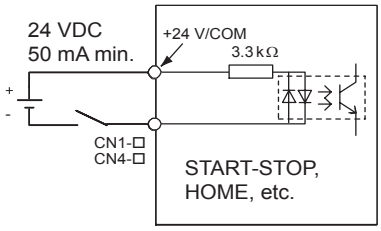
3.1.4 Interface Circuits

This section shows examples of SERVOPACK I/O signal connection to the host controller.

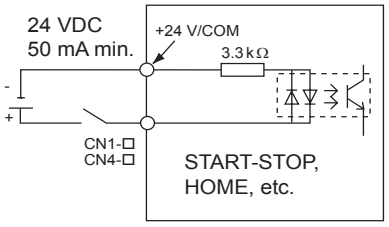
■ Interfaces with Sequence Input Circuits

The sequence input circuit interface connects through a relay or open-collector transistor circuit. Select a low-current relay otherwise a faulty contact will result.

NS600 and SERVOPACK

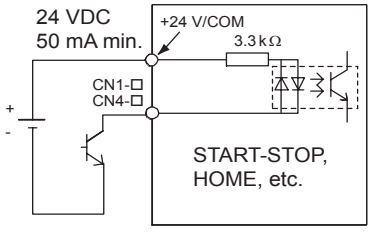


NS600 and SERVOPACK

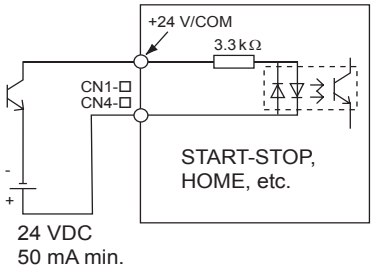


Alternative configurations

NS600 and SERVOPACK



NS600 and SERVOPACK

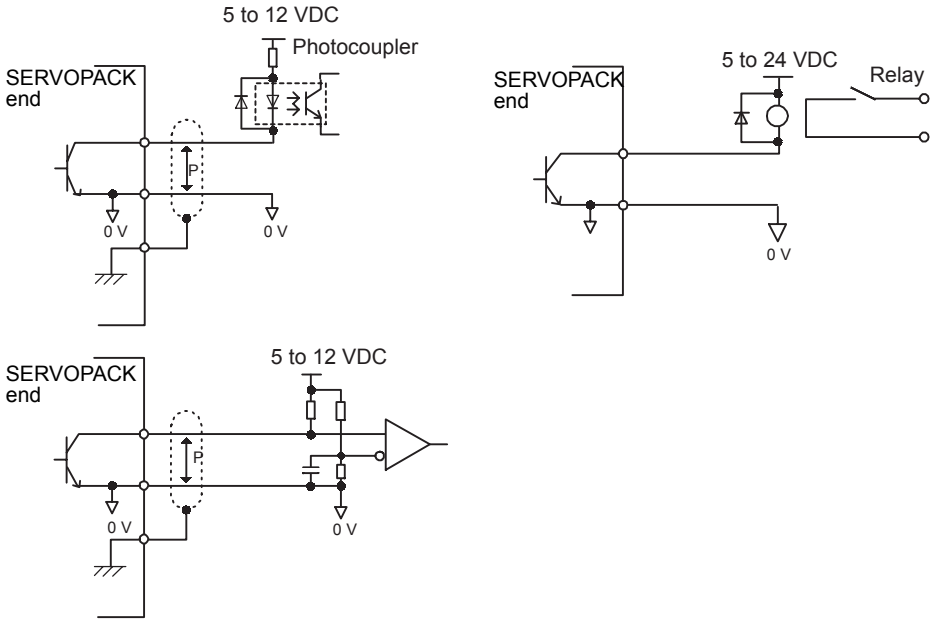


■ Interfaces with Output Circuits

Any of the following two types of SERVOPACK output circuits can be used. Form an input circuit at the host controller that matches one of two types.

- Connecting to an Open-collector Output Circuit

  Alarm code signals are output from open-collector transistor output circuits. Connect an open-collector output circuit through a photocoupler, relay or line receiver circuit.

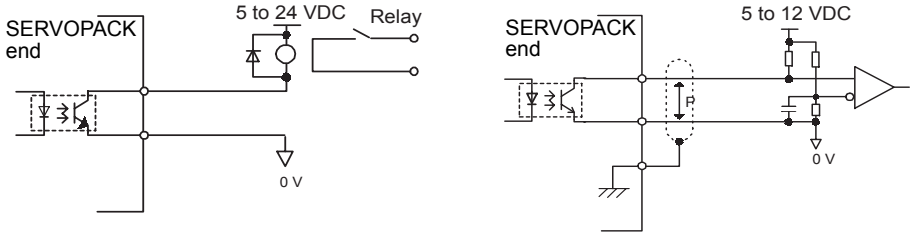


Note: The maximum allowable voltage and current capacities for open-collector output circuits are as follows:

- Voltage: 30 VDC max.
- Current: 20 mA DC max.

- Connecting to a Photocoupler Output Circuit

  Connect a photocoupler output circuit through a relay or line receiver circuit.

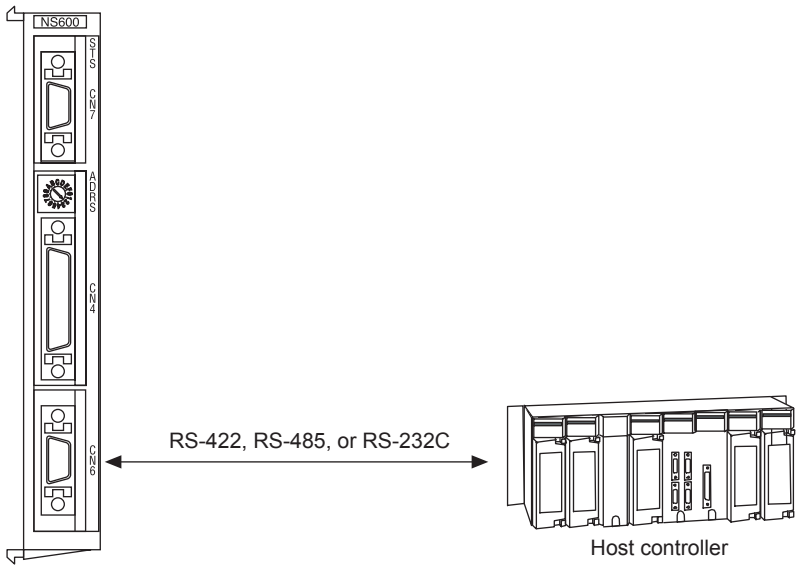


Note: The maximum allowable voltage and current capacities for photocoupler output circuits are as follows:

- Voltage: 30 VDC max.
- Current: 50 mA DC max.

3.2 Serial Command Communications Connector (CN6)

Serial commands can be used to perform operations such as positioning, setting parameters and program tables, monitoring, and other operations.



3.2.1 Communications Specifications

The following table shows the communications specifications of the CN6 connector.

Item	Specification
Interface	Full duplex (RS-422, RS-485, or RS-232C) or half duplex (RS-485) (Selectable with parameter Pn800.)
Max. Number of Axes	16 axes
Total Cable Length	RS-422/RS-485: 50 m max. RS-232C: 3 m max.
Baud Rate	9,600, 19,200, or 38,400 baud (Selectable with parameter Pn801. Factory setting: 9,600 baud)
Synchronization	Start-stop synchronization
Data Format	Start bits: 1 bit Data bits: 7 bits, ASCII Parity: 1 bit, even parity Stop bits: 1 bit
Flow Control	None
Shift Control	None

3.2.2 Communications Connector

■ Pin Layout

1	TXD			8	TXD		
		2	/TXD			9	/TXD
3	RXD			10	RXD		
		4	/RXD			11	
5	GND			12			
		6	/RXD			13	
7	RT (Terminator)			14	GND		

■ Connector Model

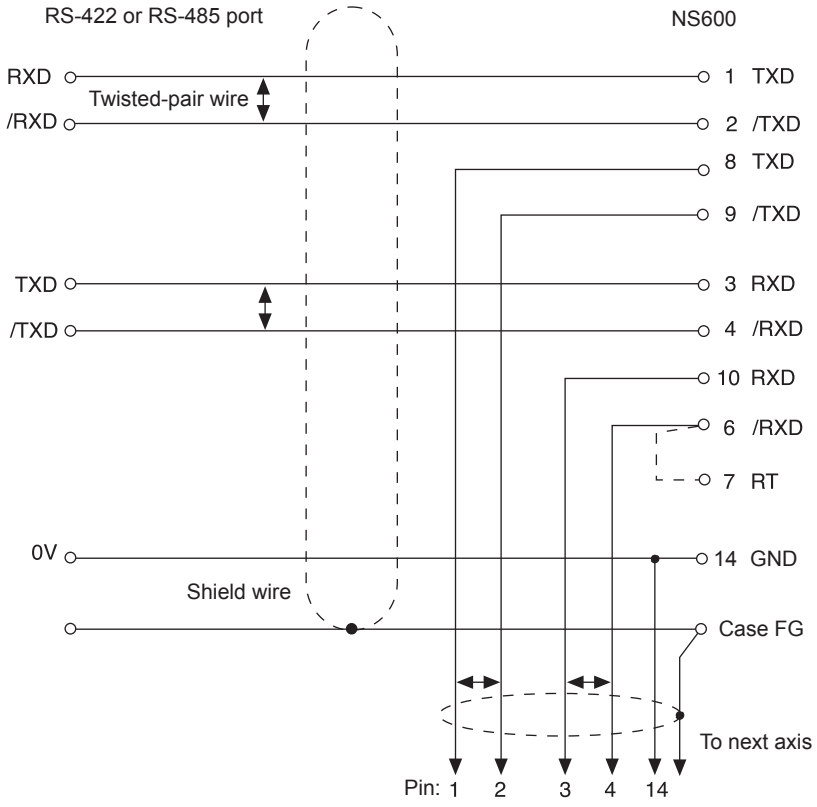
NS600-side Connector	Applicable Receptacles		
	Solder Type	Case	Manufacturer
10214-52A2JL 14-p	10114-3000VE	10314-52A0-008	Sumitomo 3M Co.

3.2.3 Connector Signal Names

Pin No.	Signal Name	Signal Circuit Name	Signal Direction
1	TXD	Transmit data (not inverted)	Host controller ← NS600
2	/TXD	Transmit data (inverted)	Personal computer ← SERVOPACK
3	RXD	Receive data (not inverted)	Personal computer → SERVOPACK
4	/RXD	Receive data (inverted)	Personal computer → SERVOPACK
5	GND	Signal ground (0 V)	---
6	/RXD	Receive data (inverted)	---
7	RT	If RT and /RXD are connected (shorted), the built-in terminator (120 Ω) will be connected between RXD and /RXD.	
8	TXD	Transmit data (not inverted)	Personal computer ← SERVOPACK
9	/TXD	Transmit data (inverted)	Personal computer ← SERVOPACK
10	RXD	Receive data (not inverted)	Personal computer → SERVOPACK
11	Reserved	Reserved pin	---
12	Reserved	Reserved pin	---
13	Reserved	Reserved pin	---
14	GND	Signal ground (0 V)	---

3.2.4 Connection Examples

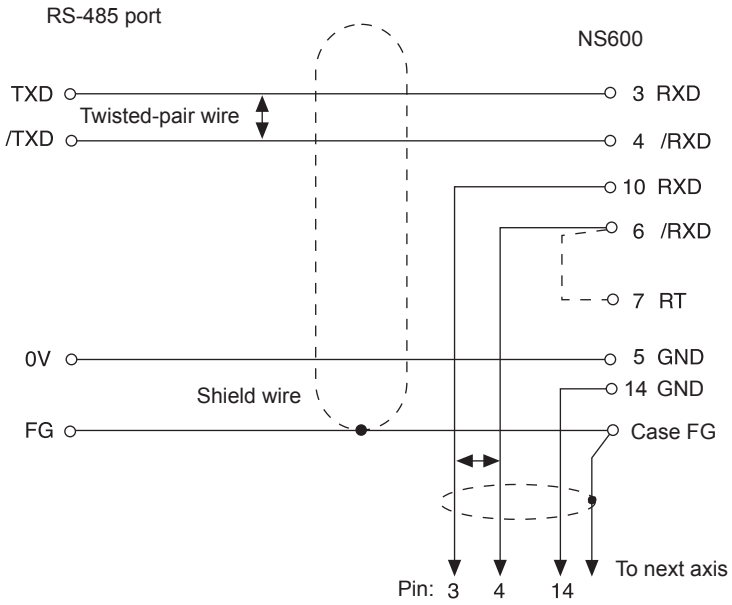
■ Full-duplex Wiring



Note: 1. Cable length: 50 m max.
2. Connect (short) the RT and /RXD pins in the last axis.

Fig. 3.3 Full-duplex Wiring

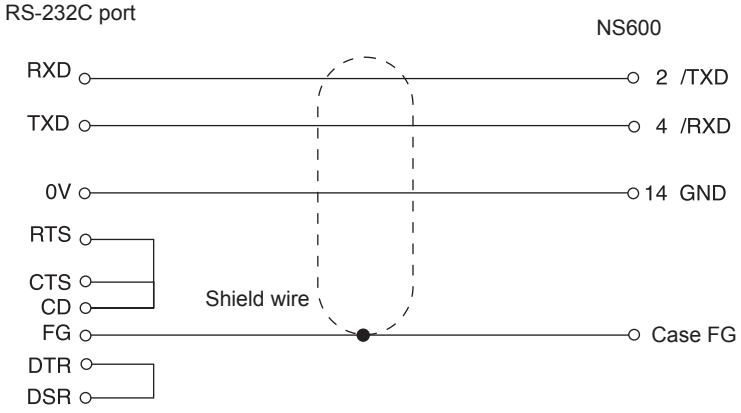
■ Half-duplex Wiring



Note: Connect (short) the RT and /RXD pins in the last axis.

Fig. 3.4 Half-duplex Wiring

■ RS-232C Wiring



Note: Cable length: 3 m max.

Fig. 3.5 RS-232C Wiring

3.2.5 RS-422/RS-485 Interface

The maximum total length for RS-422 or RS-485 cable is 50 m. Use the minimum length of cable that is needed.

The NS600's communications circuits are not isolated. If communications errors occur because of noise, use noise suppression methods such as shielded cable or ferrite cores.

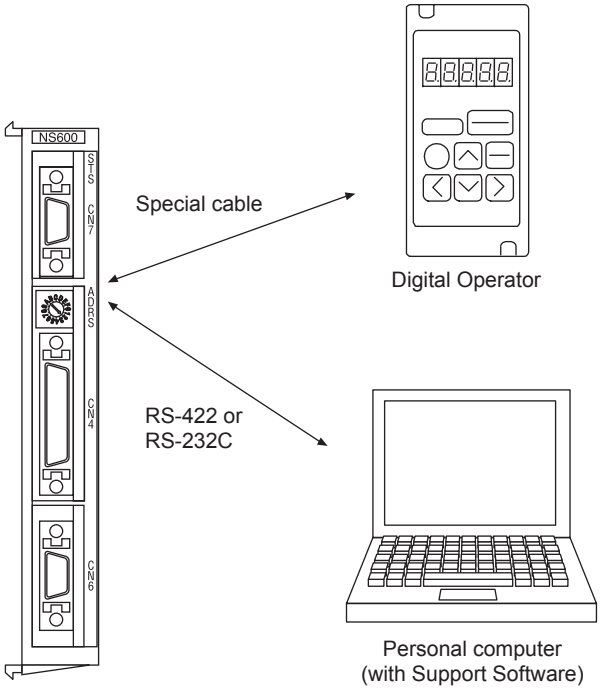
When using full-duplex wiring, connect a terminator in the host controller's reception circuit and the reception circuit of the last NS600 in the line. The NS600 has a built-in terminator (120 Ω) that is connected between the RXD and /RXD pins when the RT and /RXD pins are shorted.

When using half-duplex wiring, connect a terminator at both ends of the communications cable. The NS600 has a built-in terminator (120 Ω) that is connected between the RXD and /RXD pins when the RT and /RXD pins are shorted.

The NS600's transmission circuit is high-impedance when it is not transmitting. Pull-up or pull-down the host controller's reception circuit.

3.3 Digital Operator or Support Software Connector (CN7)

A Digital Operator or a computer running the Support Software can be used for operations such as setting parameters and program tables, monitoring, and other functions.



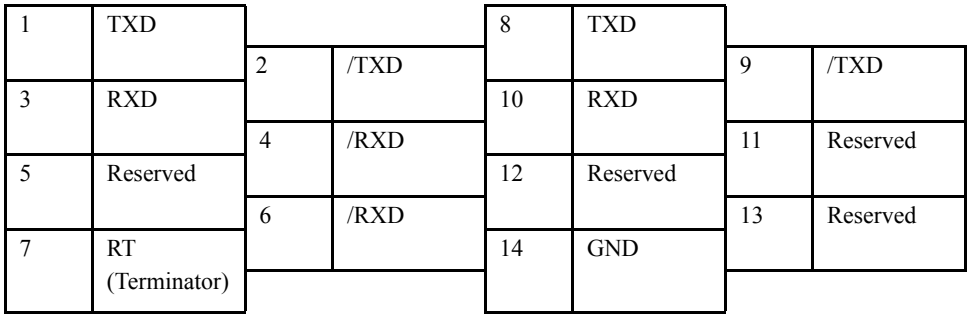
3.3.1 Communications Specifications

The following table shows the communications specifications of the CN7 connector.

Item	Specification
Interface	Full duplex (RS-422 or RS-232C)
Max. Number of Axes	16 axes
Total Cable Length	RS-422: 50 m max. RS-232C: 3 m max.
Baud Rate	9,600 baud
Synchronization	Start-stop synchronization
Data Format	Start bits: 1 bit Data bits: 7 bits, ASCII Parity: 1 bit, even parity Stop bits: 1 bit
Flow Control	None
Shift Control	None

3.3.2 Communications Connector

■ Pin Layout



■ Connector Model

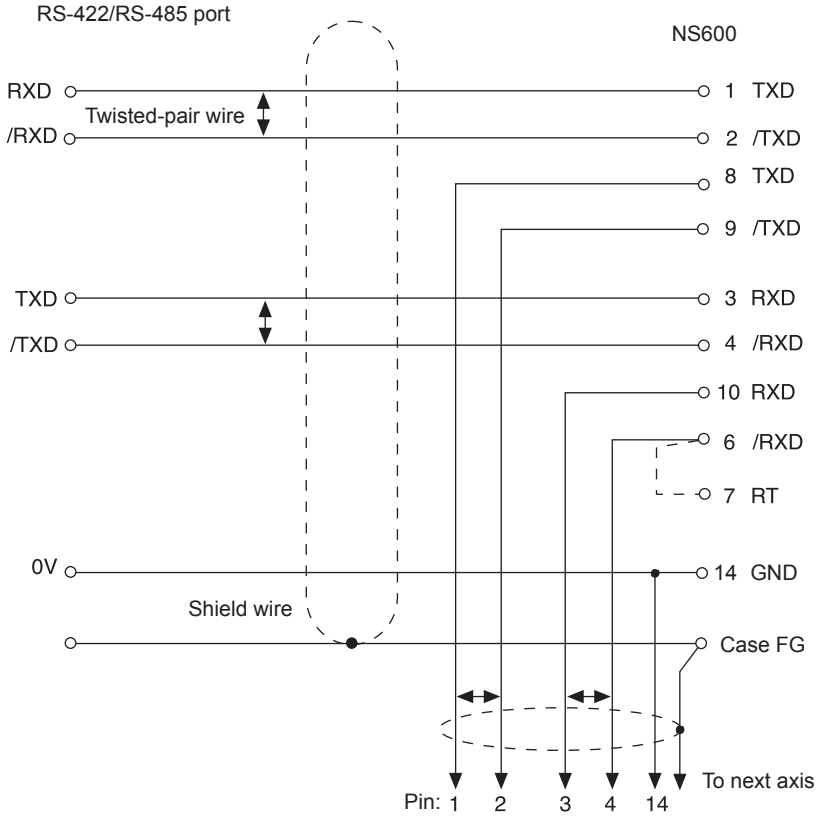
NS600-side Connector	Applicable Receptacles		
	Solder Type	Case	Manufacturer
10214-52A2JL 14-p	10114-3000VE	10314-52A0-008	Sumitomo 3M Co.

3.3.3 Connector Signal Names

Pin No.	Signal Name	Signal Circuit Name	Signal Direction
1	TXD	Transmit data (not inverted)	Personal computer ← NS600
2	/TXD	Transmit data (inverted)	Personal computer ← SERVOPACK
3	RXD	Receive data (not inverted)	Personal computer → SERVOPACK
4	/RXD	Receive data (inverted)	Personal computer → SERVOPACK
5	Reserved	Reserved pin	---
6	/RXD	Receive data (inverted)	---
7	RT	If RT and /RXD are connected (shorted), the built-in terminator (120 Ω) will be connected between RXD and /RXD.	
8	TXD	Transmit data (not inverted)	Personal computer ← SERVOPACK
9	/TXD	Transmit data (inverted)	Personal computer ← SERVOPACK
10	RXD	Receive data (not inverted)	Personal computer → SERVOPACK
11	Reserved	Reserved pin	---
12	Reserved	Reserved pin	---
13	Reserved	Reserved pin	---
14	GND	Signal ground (0 V)	---

3.3.4 Connection Examples

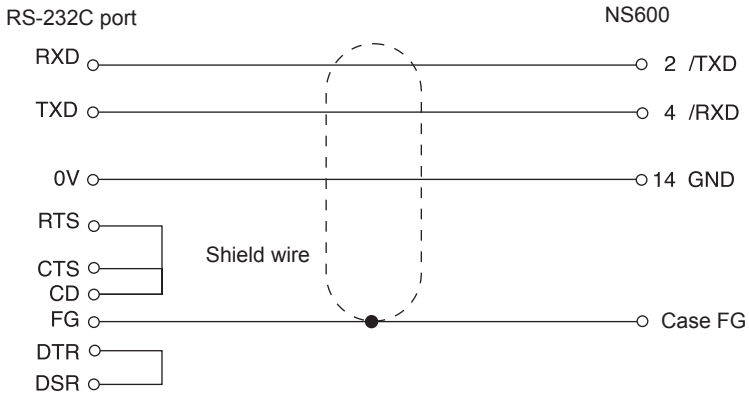
■ Using RS-422 Cable



Note: 1. Cable length: 50 m max.
2. Connect (short) the RT and /RXD pins in the last axis.

Fig. 3.6 Wiring with RS-422 Cable

■ Using RS-232C Cable



Note: Cable length: 3 m max.

Fig. 3.7 Wiring with RS-232C Cable

3.3.5 RS-422 Interface

The maximum total length for an RS-422 cable is 50 m. Use the minimum length of cable that is needed.

The NS600's communications circuits are not isolated. If communications errors occur because of noise, use noise suppression methods such as shielded cable or ferrite cores.

When using RS-422 cable, connect a terminator in the host controller's reception circuit and the reception circuit of the last NS600 in the line. The NS600 has a built-in terminator (120 Ω) that is connected between the RXD and /RXD pins when the RT and /RXD pins are shorted.

The NS600's transmission circuit is high-impedance when it is not transmitting. Pull-up or pull-down the host controller's reception circuit.

3.4 Power Loss in the NS600

Refer to *3.3.4 SERVOPACK Power Losses* in the *SGM□H/SGDH User's Manual: Design and Maintenance* (Manual No.: SIE-S800-32.2) for a table showing the SERVOPACK power losses at the rated output.

Table 3.1 NS600 Specifications

Item	Specification
Min. operating voltage	5.05 V
Max. operating voltage	5.25 V
Max. operating current	500 mA
Max. power loss	2.6 W

The NS600's power is supplied from the SERVOPACK.

4

Trial Operation

This chapter describes a two-step trial operation. Be sure to complete step 1 before proceeding to step 2.

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4.2 Step 1: Trial Operation for Servomotor without Load - - - - - - - 4-3
4.3 Step 2: Trial Operation with the Servomotor Connected to the Machine 4-10

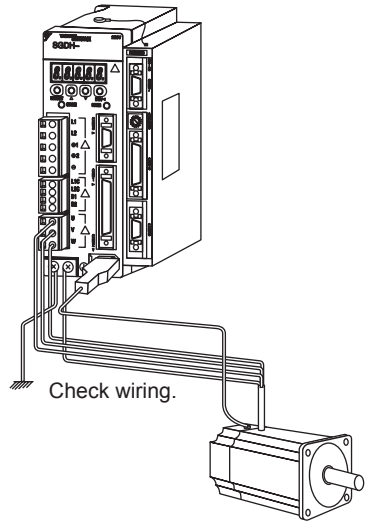
4.1 Two-step Trial Operation

Make sure that all wiring is completed prior to starting trial operation.

Perform the trial operation in the order given below (steps 1 and 2) for your safety.
See *4.2 Step 1: Trial Operation for Servomotor without Load* and *4.3 Step 2: Trial Operation with the Servomotor Connected to the Machine* for more details on the trial operation.

Step 1: Trial Operation for Servomotor without Load

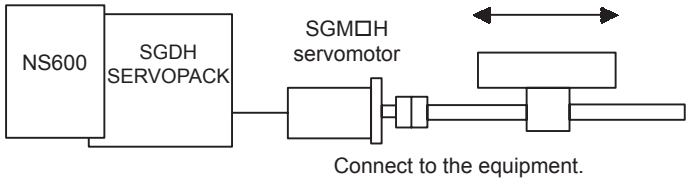
Make sure the servomotor is wired properly and then turn the shaft prior to connecting the servomotor to the equipment.



Do not connect to the equipment.

Step 2: Trial Operation with the Equipment and Servomotor Connected

Adjust the SERVOPACK according to equipment characteristics,
connect the servomotor to the equipment, and perform the trial operation.



4.2 Step 1: Trial Operation for Servomotor without Load

⚠ CAUTION

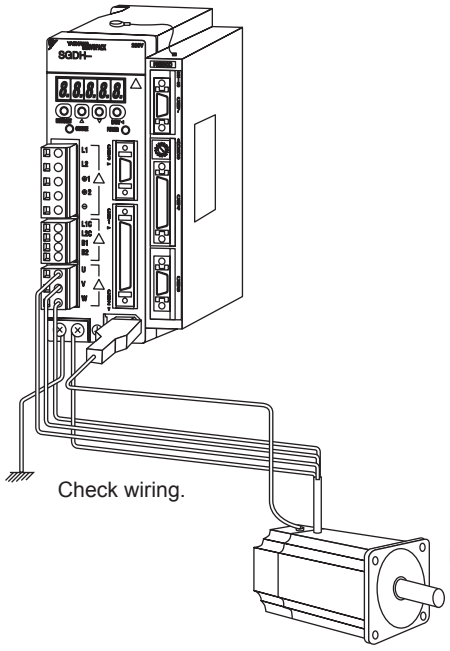
- Do not operate the servomotor while it is connected to the equipment.

  To prevent accidents, initially perform step 1 where the trial operation is conducted under no-load conditions (with all couplings and belts disconnected).

In step 1, make sure that the servomotor is wired properly as shown below. Incorrect wiring is generally the reason why servomotors fail to operate properly during trial operation.

- Check main power supply circuit wiring.
- Check servomotor wiring.
- Check I/O signal wiring (CN1 and/or CN4) if these connectors are being used.
- Check Serial Command Communications wiring (CN6) if this connector is being used.

Make sure that adjustments in the host controller and other adjustments are completed as much as possible in step 1 (prior to connecting the servomotor to equipment).

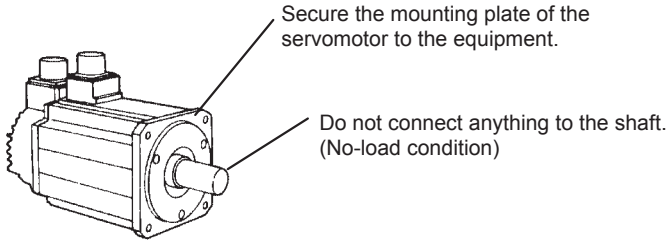


IMPORTANT

Check the items on the following pages in the order given during the servomotor trial operation.

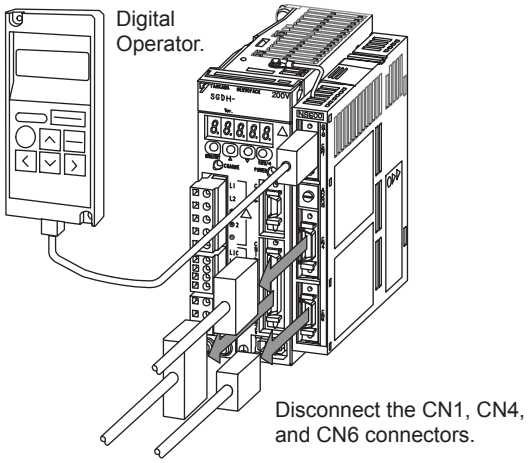
See *5.3.3 Brake Interlock Output Signal (/BK)* if you are using a servomotor with brakes.

1. Secure the servomotor.



Secure the servomotor mounting plate to the equipment in order to prevent the servomotor from moving during operation.

2. Check the wiring.



Disconnect the CN1, CN4, and CN6 connectors and check servomotor wiring in the power supply circuit. The I/O signals (CN1 and CN4) and Serial Command Signals (CN6) are not used. Connect the Digital Operator to the CN7 connector.

3. Turn ON power.

Normal displays

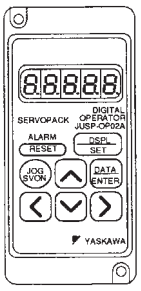
Example of alarm display

Turn ON SERVOPACK power. If the SERVOPACK has turned ON normally, the Digital Operator's display will appear as shown above. Power is not supplied to the servomotor because the servo is OFF.

If an alarm display appears on the LED indicator as shown above, the power supply circuit, servomotor wiring, or encoder wiring is incorrect. In this case, turn OFF power and take appropriate action. See *Chapter 9* Troubleshooting.

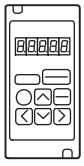
INFO If an absolute encoder is used, it must be set up. Refer to *5.5.4 Absolute Encoder Setup (Initialization)*.

4. Operate with Digital Operator.

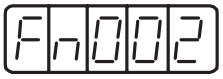


Operate the servomotor using the Digital Operator. Check to see if the servomotor runs normally.

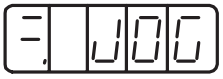
Use the following procedure to operate the servomotor with the Digital Operator. Refer to *Chapter 7 Using the Digital Operator* for details on using the Digital Operator.



a) Press the DSPL/SET Key to select Fn002 in the auxiliary function mode.

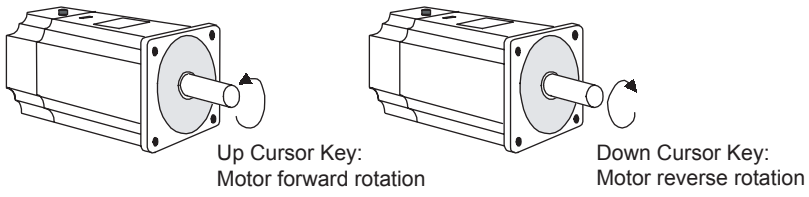


b) Press the DATA/ENTER Key to select the Digital Operator operation mode. Operation is now possible using the Digital Operator.



c) Press the SVON Key to set to servo ON state (with motor power turned ON).

d) Press the Up Cursor Key or Down Cursor Key to operate the motor. The motor keeps operating while the key is pressed.



e) Press the DATA/ENTER Key, and the display will revert to Fn002. This sets to the servo OFF state (with motor power turned OFF). Alternatively, press the SVON Key to set to the servo OFF state.

This disables operation under the Digital Operator control.

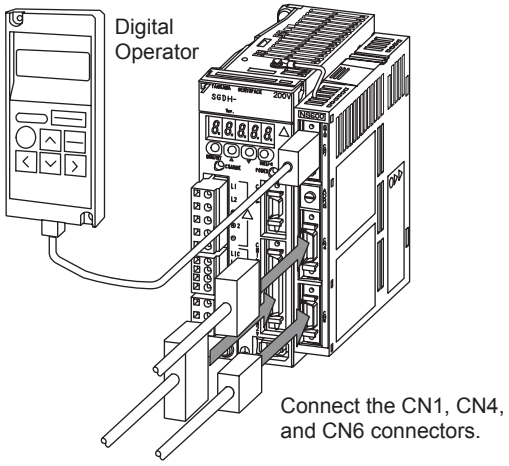
Use the following parameter to set or modify motor speed when operating the servomotor from the Digital Operator.

Parameter	Signal	Setting (min^{-1})
Pn304	JOG speed	Initial setting: 500

INFO

The rotation direction of the servomotor depends on the setting of parameter Pn000.0 “Rotation Direction.” The above example applies when Pn000.0 is set to “0”, the factory setting.

5. Connect the signal lines.



Use the following procedure to connect the CN1, CN4, and CN6 connectors if these connectors are being used. The Digital Operator can remain connected.

a) Turn OFF power.

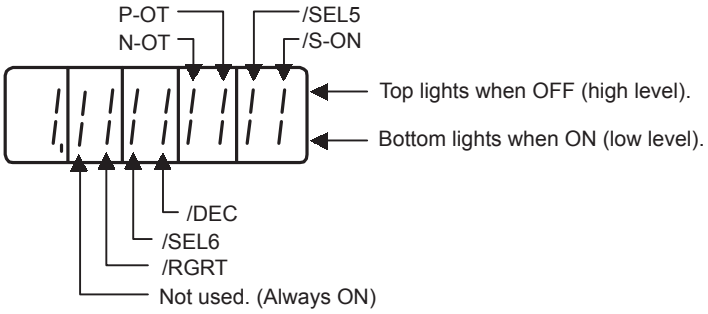
b) Connect the CN1, CN4, and CN6 connectors.

c) Turn ON power again.

6. Check the CN1 input signals if CN1 input signals are being used.
Check the input signal wiring in Monitor Mode using the Digital Operator by monitoring Un005 (the input signal monitor). Refer to *Chapter 7* Using the Digital Operator for details on using the Digital Operator.

Turn ON and OFF each signal line to see if the LED monitor bit display changes as shown below.

Input signal LED display



Input Signal Status	LED Display
OFF (high level)	Top LED indicators light.
ON (low level)	Bottom LED indicators light.

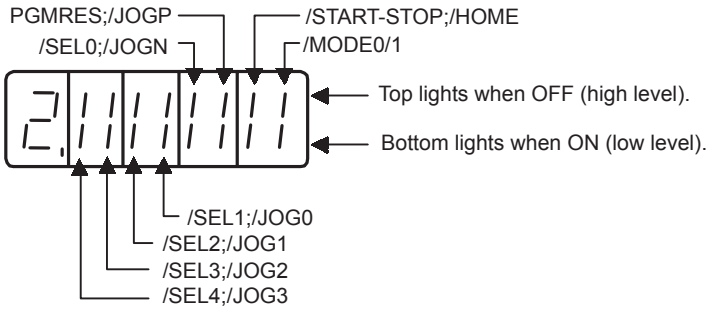
IMPORTANT

The servomotor will not operate properly if the following signal lines are not wired correctly. Short the signal lines if they will not be used. The input signal selections (parameters Pn803 to Pn80F) can be used to eliminate the need for external short circuiting.

Signal Symbol	Connector Pin No.	Description
P-OT	CN1-42	The servomotor can rotate in the forward direction when this signal is ON. The servomotor is in forward overtravel status (Forward Run Prohibited) when this signal is OFF.
N-OT	CN1-43	The servomotor can rotate in the reverse direction when this signal is ON. The servomotor is in reverse overtravel status (Reverse Run Prohibited) when this signal is OFF.
/S-ON	CN1-40	The servomotor is turned ON when this signal is ON. Leave the servomotor OFF.
+24VIN	CN1-47	Control power supply terminal for sequence signals.

7. Check the CN4 input signals if CN4 input signals are being used.
   Check the input signal wiring in Monitor Mode using the Digital Operator by monitoring Un801. Refer to *Chapter 7* Using the Digital Operator for details on using the Digital Operator.

   Turn ON and OFF each signal line to see if the LED monitor bit display changes as shown below.



Input Signal Status	LED Display
OFF (high level)	Top LED indicators light.
ON (low level)	Bottom LED indicators light.

IMPORTANT

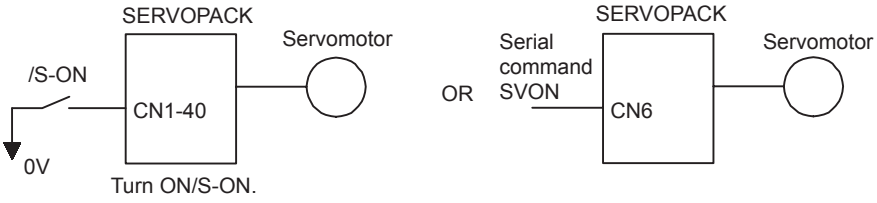
The CN1 and CN4 input signals can also be monitored from CN6 connector using the "IN1" and "IN2" Serial Commands. Refer to *Chapter 6 Serial Command Communications* for details on the Serial Commands.

8. Check the CN6 serial command communications if CN6 serial commands are being used. Check the serial communications in Monitor Mode using the Digital Operator by monitoring Un80D through Un811. Refer to *Chapter 7* Using the Digital Operator for details on using the Digital Operator.

   Check the communications protocol and baud rate set in parameters Pn800 and Pn801. Change the settings if necessary. If the settings are changed, the new settings is enabled by turning the control power supply OFF and then ON again.

   Refer to *Chapter 7* Using the Digital Operator for the procedure to use when editing parameters. Once serial communications have been established, serial communications can be used for operations such as editing parameters and monitoring.

9. Turn ON the servo with /S-ON or the SVON serial command.



Display when servo is ON.

If the system is setup correctly, the servomotor will turn ON and the Digital Operator display shown above will appear. If an alarm display appears, take appropriate action as described in *Chapter 9* Troubleshooting.

4.3 Step 2: Trial Operation with the Servomotor Connected to the Machine

⚠ WARNING

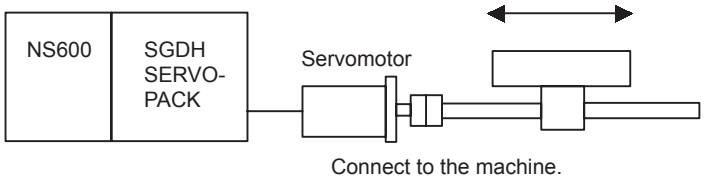
- Follow the procedure below for step-2 trial operation precisely as given.

  Malfunctions that occur after the servomotor is connected to the equipment may not only damage the equipment, but may also cause an accident resulting death or injury.

Before proceeding to step 2, repeat step 1 (servomotor trial operation without a load) until you are fully satisfied that all items including parameters and wiring have been tested completely.

After step 1 has been completed, proceed to step 2 for trial operation with the servomotor connected to the equipment. The purpose of step 2 is to adjust the SERVOPACK according to equipment characteristics.

- Use autotuning to match the SERVOPACK to equipment characteristics.
- Match the direction of rotation and speed to equipment specifications.
- Check the final control form.



Follow the procedures below to perform the trial operation.

1. Make sure power is OFF.
2. Connect the servomotor to the equipment.
   See *2.1 Servomotors* in the *SGM□H/SGDH User's Manual: Design and Maintenance* (Manual No.: SIE-S800-32.2) for more details on connecting the servomotor.
3. Use autotuning to match the SERVOPACK to equipment characteristics.
   See *6.3 Autotuning* in the *SGM□H/SGDH User's Manual: Design and Maintenance* (Manual No.: SIE-S800-32.2) for details.
4. Operate the servomotor with Digital I/O or Serial Mode operation.
   See *Chapter 5 Parameter Settings and Functions* and *Chapter 6 Serial Command Communications* for details.
5. Set and record parameters.
   Set parameters as required and record all settings for use later in maintenance.

This completes the trial operation procedure.

⚠ WARNING

The servomotor will not be broken in completely during the trial operation. Therefore, let it the system run for a sufficient amount of additional time to ensure that it is properly broken in.

5

Parameter Settings and Functions

This chapter describes the procedure for setting and applying parameters.

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■ Before Reading this Chapter

This chapter describes the use of the I/O signals in the SGDH SERVOPACK and NS600 (I/O signals in the CN1 and CN4 connectors) as well as the procedure for setting the related parameters for the intended purposes.

The following sections can be used as references for this chapter.

- Lists of CN1 and CN4 I/O signals: See *3.1.3 I/O Signal Names and Functions*.
- CN1 and CN4 I/O signal terminal layout: See *3.1.2 Terminal Layout on I/O Signal Connectors CN1 and CN4*.
- List of parameters: See *Appendix A List of Parameters*.

■ Parameter Configurations

Parameters are comprised of the types shown in the following table. See *Appendix A List of Parameters*.

Type	Parameter No.	Description
Function Selection Parameters	Pn000 to Pn005 Pn819	Select basic and application functions such as the type of control or the stop mode used when an alarm occurs.
Servo Gain and Other Parameters	Pn100 to Pn123	Set numerical values such as speed and position loop gains.
Position Control Parameters	Pn200 to Pn208	Set position control parameters such as S-shaped curve.
Speed Control Parameter	Pn308	Set speed control parameters such as the Speed Feedback Filter Time Constant.
Torque Control Parameters	Pn401 to Pn409	Set torque control parameters such as the torque limit values.
Sequence Parameters	Pn500 to Pn509 Pn803 to Pn818	Sets conditions for the sequence I/O signals.
Positioning Parameters	Pn81A to Pn822	Sets parameters related to positioning.
Homing Parameters	Pn823 to Pn828	Sets parameters related to homing.
Serial Communications Parameters	Pn800 to Pn802	Sets parameters related to serial communications through CN6.
Setup Information Parameters	Pn829 to Pn834	Do not change these parameters. These parameters are used by the Support Software.
Others	Pn600 to Pn601	Sets other parameters.

5.1 Restrictions on SGDH SERVOPACK Parameters

The following parameters are set automatically when an NS600 is installed on an SGDH SERVOPACK. Do not change these parameters because they are reserved for system use. Also, the SGDH SERVOPACK will be set for position control. It is not necessary to set parameters related to speed control or torque control, so those parameters should not be changed.

After the NS600 is installed, it will take about 2 seconds before the SERVOPACK starts up for the first time because the parameters are set automatically the first time that the power is turned ON.

Table 5.1 Setting-restricted Parameters

Parameter	Digit	Name	Setting	Description
Pn000	1	Control Method	1	Position control
	2	Axis Address	0 to F	Copies the address set on the NS600's rotary switch.
Pn002	0	T-REF Allocation (Torque Limit/ Torque Feed-forward)	0	Torque limit and torque feed-forward cannot be input by analog voltage inputs.
	3	Full Closed Loop Usage	0	Full-closed loop cannot be used.
Pn004	1	Reserved	0	Not used.
Pn005	0	Reserved	0	Not used.
Pn200	2	Clear Operation	0	Clears the position error when the servo is OFF.
Pn207	0	Position Reference Filter Selection	1	S-shaped Curve
	1	Position Control Option (V-REF as Speed Forward)	0	An analog voltage input cannot be used as a speed feed-forward input.
Pn50A	0	Input Signal Mapping	1	Input signals can be allocated.
	1	/S-ON	8	Not used. (SI0 is detected as /S-ON by the NS600.)
	2	/P-CON	8	Not used.
	3	/P-OT	8	Not used. (SI2 is detected as P-OT by the NS600.)
Pn50B	0	/N-OT	8	Not used. (SI3 is detected as N-OT by the NS600.)
	1	/ALM-RST	8	Not used.
	2	/P-CL	8	Not used.
	3	/N-CL	8	Not used.
Pn50C	0	/SPD-D	8	Not used.
	1	/SPD-A	8	Not used.
	2	/SPD-B	8	Not used.
	3	/C-SEL	8	Not used.
Pn50D	0	/Z-CLAMP	8	Not used.
	1	/INHIBIT	8	Not used.
	2	/G-SEL	8	Not used.
	3	Reserved	8	Not used.

Table 5.1 Setting-restricted Parameters (cont'd)

Parame-ter	Digit	Name	Setting	Description
Pn50E	0	/COIN	0	Not used.
	1	/V-CMP	0	Not used.
	2	/TGON	0	Not used.
	3	/S-RDY	3	Always SO3.
Pn50F	0	/CLT	0	Not used.
	1	/VLT	0	Not used.
	2	/BK	2	Always SO2.
	3	/WARN	1	Always SO1.
Pn510	0	/NEAR	0	Not used.
	1	Reserved	0	Not used.
	2	Not used.	0	Not used.
	3	Not used.	0	Not used.
Pn512	0	SO1 Reverse	0 or 1	This value is set by the NS600 based on Pn816.
	1	SO2 Reverse	0 or 1	This value is set by the NS600 based on Pn817.
	2	SO3 Reverse	0 or 1	This value is set by the NS600 based on Pn818.
	3	Not used.	0	Not used.

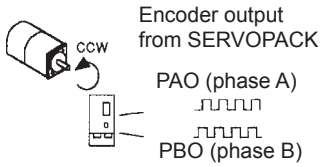
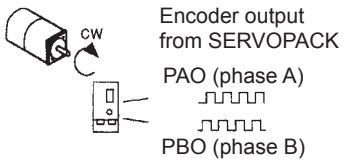
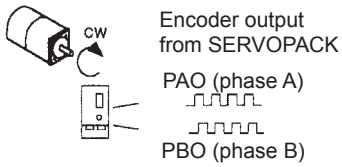
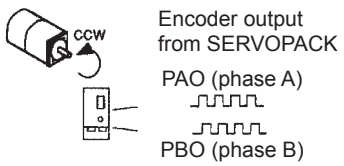
5.2 Settings According to Device Characteristics

This section describes the procedure for setting parameters according to the dimensions and performance of the equipment used.

5.2.1 Switching Servomotor Rotation Direction

The SERVOPACK has a Reverse Rotation Mode that reverses the direction of servomotor rotation without rewiring. Forward rotation in the standard setting is defined as counterclockwise as viewed from the load.

With the Reverse Rotation Mode, the direction of servomotor rotation can be reversed without changing other items. The direction (+, -) of shaft motion is reversed.

	Standard Setting	Reverse Rotation Mode
Forward Reference		
Reverse Reference		

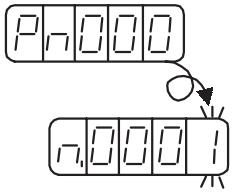
■ Setting Reverse Rotation Mode

Use parameter Pn000.0.

Pn000.0	Direction Selection	Factory Setting: 0

Use the following settings to select the direction of servomotor rotation.

Setting	Description	
0	Forward rotation is defined as counterclockwise (CCW) rotation as viewed from the load.	(Standard setting)
1	Forward rotation is defined as clockwise (CW) rotation as viewed from the load.	(Reverse Rotation Mode)



5.2.2 Setting the Overtravel Limit Function

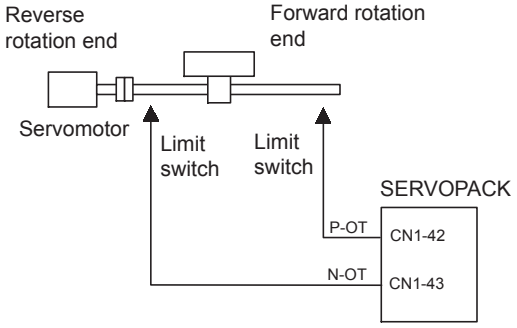
The overtravel limit function forces movable equipment parts to stop if they exceed the allowable range of motion.

■ Using the Overtravel Function

To use the overtravel function, connect the overtravel limit switch input signal terminals shown below to the correct pins of the SERVOPACK CN1 connector.

→ Input P-OT CN1-42	Forward Run Prohibited (Forward Overtravel)
→ Input N-OT CN1-43	Reverse Run Prohibited (Reverse Overtravel)

Connect limit switches as shown below to prevent damage to the devices during linear motion.



Drive status with an input signal ON or OFF is shown in the following table.

P-OT	ON (Input photocoupler ON)	Normal operating status. (Rotation allowed in both directions.)
	OFF (Input photocoupler OFF)	Forward run prohibited. (Reverse rotation allowed.)
N-OT	ON (Input photocoupler ON)	Normal operating status. (Rotation allowed in both directions.)
	OFF (Input photocoupler OFF)	Reverse run prohibited. (Forward rotation allowed.)

■ Changing the Input Signal Settings

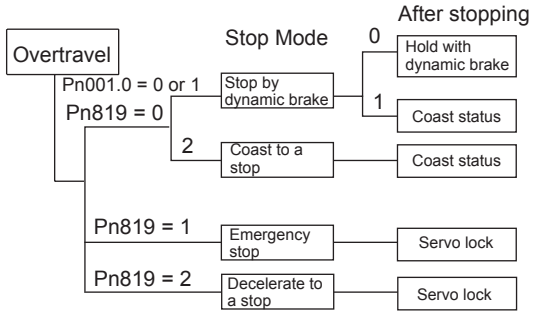
The overtravel input signal settings can be changed with parameters Pn80C and Pn80D.

Parame-ter	Signal	Pin No.	Settings	Factory Setting
Pn80C	P-OT	CN1-42	0: Photocoupler OFF = Forward OT Status (Forward run prohibited) 1: Photocoupler ON = Forward OT Status (Forward run prohibited) 2: Always Forward OT Status (Forward run is always prohibited.) 3: Forward run is always allowed and P-OT is not used.	0
Pn80D	N-OT	CN1-43	0: Photocoupler OFF = Reverse OT Status (Reverse run prohibited) 1: Photocoupler ON = Reverse OT Status (Reverse run prohibited) 2: Always Reverse OT Status (Reverse run is always prohibited.) 3: Reverse run is always allowed and N-OT is not used.	0

■ Servomotor Stop Mode for P-OT and N-OT Input Signals

Set the following parameter to specify the Servomotor Stop Mode when P-OT and N-OT input signals are used.

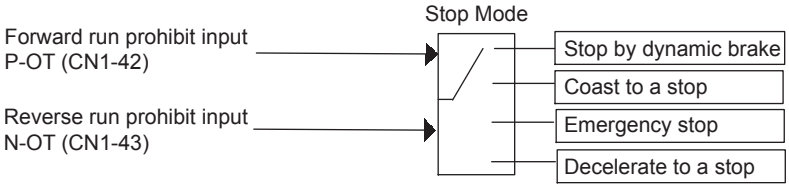
Pn819	Overtravel Stop Mode	Factory Setting: 0



Parame-ter	Name	Setting	Description
Pn819	Overtravel Stop Mode	0	Stops the servomotor the same way as turning the servo OFF (according to Pn001.0).
		1	Stop the servomotor by emergency stop and locks the servomotor.
		2	Decelerates the servomotor to a stop and locks the servomotor. (Deceleration setting in parameter Pn820)

Set the deceleration rate with the deceleration time setting in Pn820.

Pn820	Decelera-tion	Unit: ×1,000 Reference units/min/ms	Setting Range: 1 to 99,999,999	Factory Setting: 1,000	Enabled when Pn819 = 2.



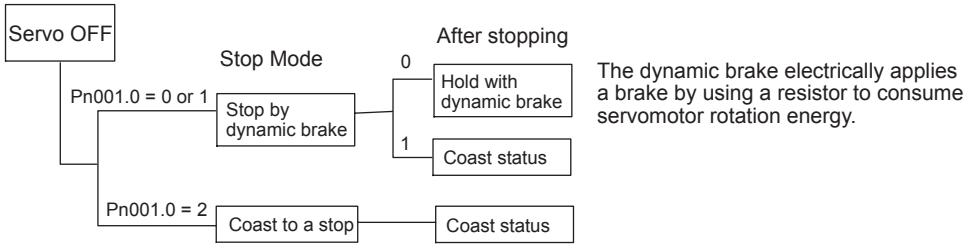
■ Servo OFF Stop Mode Selection

The SGDH SERVOPACK turns OFF under the following conditions:

- Servo ON input signal (/S-ON) is turned OFF or a Servo OFF command (SVOFF) is sent.
- Servo alarm occurs.
- The main power is turned OFF.

Specify the Stop Mode if any of these occurs during operation.

Pn001.0	Servo OFF or Alarm Stop Mode	Factory Setting: 0	---



Parameter	Setting	Description
Pn001.0	0 (Factory setting)	Uses the dynamic brake to stop the servomotor, and maintains dynamic brake status after stopping.
	1	Uses the dynamic brake to stop the servomotor, and cancels dynamic brake status after stopping to go into coast status.
	2	Coasts the servomotor to a stop. The servomotor is turned OFF and stops due to equipment friction.

Note: If the servomotor is stopped or rotating at extremely low speed when the items above are set at 0 (dynamic brake status after stopping with the dynamic brake), then braking power is not generated and the servomotor will stop the same as in coast status.

5.2.3 Software Position Limit Settings and the Moving Method

Set the following parameters to limit the software position.

Parameter	Name	Unit	Setting Range	Factory Setting
Pn81A	Moving Method	---	0: Linear 1: Rotary (Shortest path) 2: Rotary (Forward) 3: Rotary (Reverse)	0
Pn81B	Position Reference Forward Limit	Reference Units	–99,999,999 to 99,999,999	99,999,999
Pn81C	Position Reference Reverse Limit	Reference Units	–99,999,999 to 99,999,999	-99,999,999

Setting the Moving Method

- Pn81A = 0: Linear

  An error will occur if the positioning target position exceeds the software limit.

  If the motor reaches the software limit during operation with Jog commands or the Jog speed table, the motor will be decelerated and stopped at the deceleration rate specified in Pn820.

- Pn81A = 1: Rotary (Shortest Path)

  When the positioning target position has been specified as an absolute position, the motor will rotate in the shortest-path direction. The settings in Pn81B and Pn81C specify the start limit and end limit of the rotational coordinates.

- Pn81A = 2: Rotary (Forward)

  When the positioning target position has been specified as an absolute position, the motor will always rotate in the forward direction. The settings in Pn81B and Pn81C specify the start limit and end limit of the rotational coordinates.

- Pn81A = 3: Rotary (Reverse)

  When the positioning target position has been specified as an absolute position, the motor will always rotate in the reverse direction. The settings in Pn81B and Pn81C specify the start limit and end limit of the rotational coordinates.

5.2.4 Limiting Torques

The SGDH SERVOPACK can limit the maximum output torque to protect the equipment or workpiece.

Maximum torque is limited to the values set in the following parameters. Set the torque limits as a percentage of the rated torque.

Pn402	Forward Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 800
Pn403	Reverse Torque Limit	Unit: %	Setting Range: 0 to 800	Factory Setting: 800

1. If the torque limit is set higher than the maximum torque of the servomotor, the maximum torque of the servomotor is the limit.
2. The external torque limits (/P-CL and /N-CL) cannot be used when an NS600 is installed on an SGDH SERVOPACK.

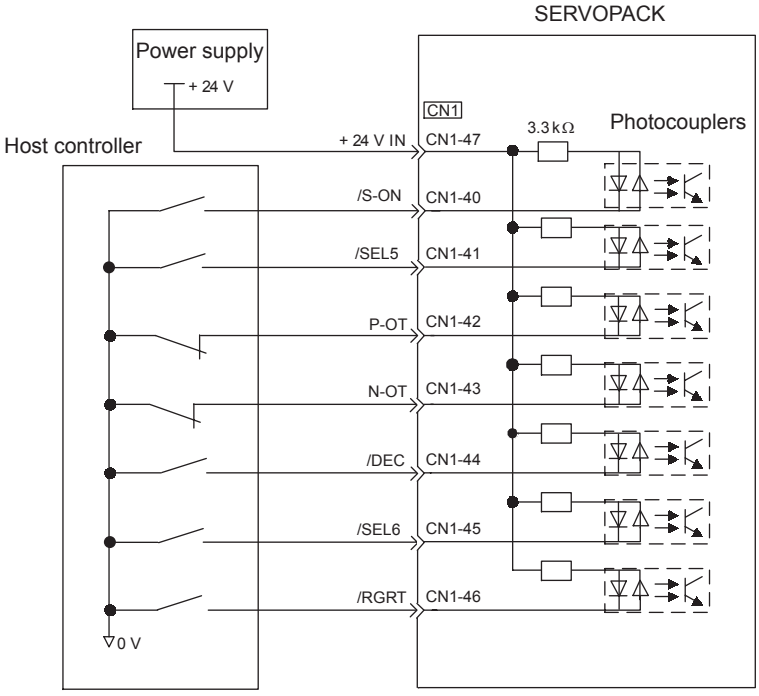
5.3 Sequence I/O Signals

Sequence I/O signals are used to control operation of the SERVOPACK and NS600. Connect these signal terminals as required.

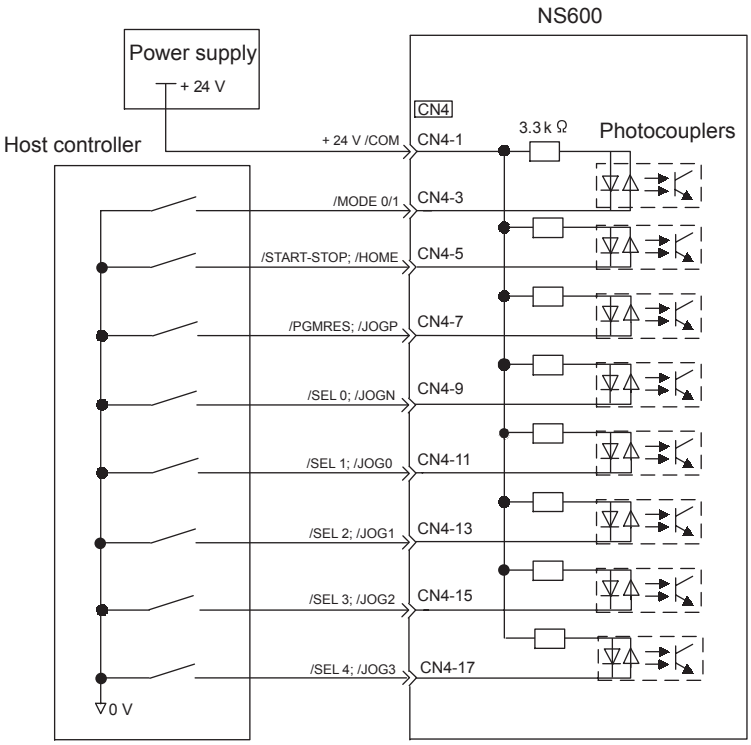
■ Input Signal Connections

Connect the Sequence Input signals as shown below.

CN1 Connector



CN4 Connector



5

IMPORTANT

Provide an external power supply; the SERVOPACK and NS600 do not have an internal 24-V power supply.

Yaskawa recommends using the same external power supply as that used for output circuits. The allowable voltage range for the 24-V sequence input circuit power supply is 11 to 25 V. Although a 12-V power supply can be used, contact faults can easily occur for relays and other mechanical contacts under low currents. Confirm the characteristics of relays and other mechanical contacts before using a 12-V power supply.

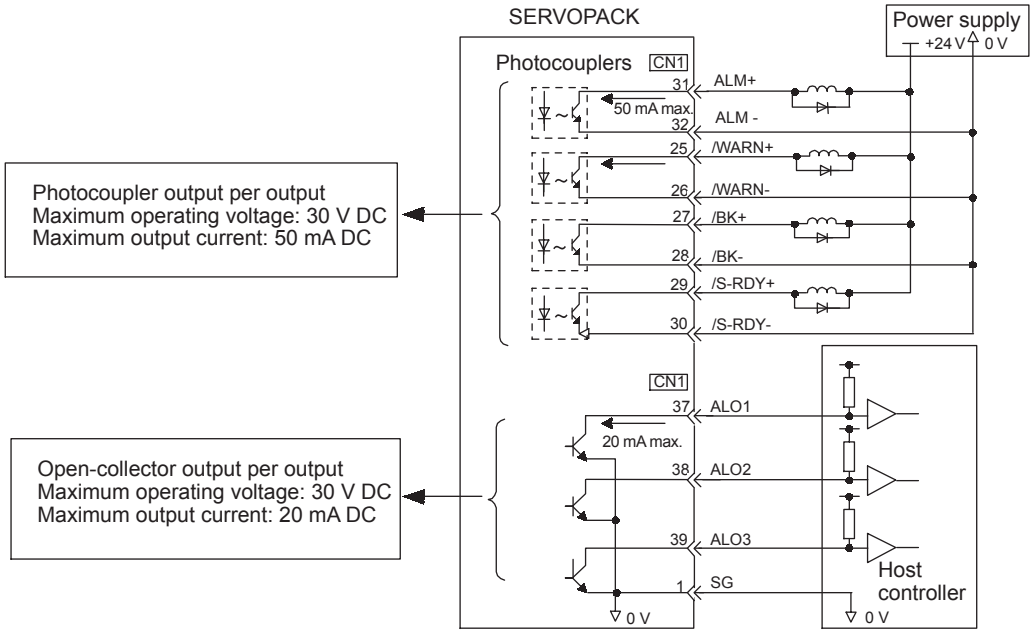
■ Input Signal Specifications (CN1 and CN4)

Item	Specification
Signal Names	CN1: /S-ON, P-OT, N-OT, /DEC, /RGRT CN4: /MODE0/1, /START-STOP, /HOME, /PGMRES, /JOGP, /SEL0, /JOGN, /SEL1, /JOG0, /SEL2, /JOG1, /SEL3, /JOG2, /SEL4, /JOG3
Input Form	Sinking or Sourcing
Isolation	Photocoupler
Operating Voltage	11 to 25 V DC
Input Impedance	3.3 kΩ
ON Current	8 mA max. each
OFF Current	1 mA max. each (OFF voltage = 1.0 V)

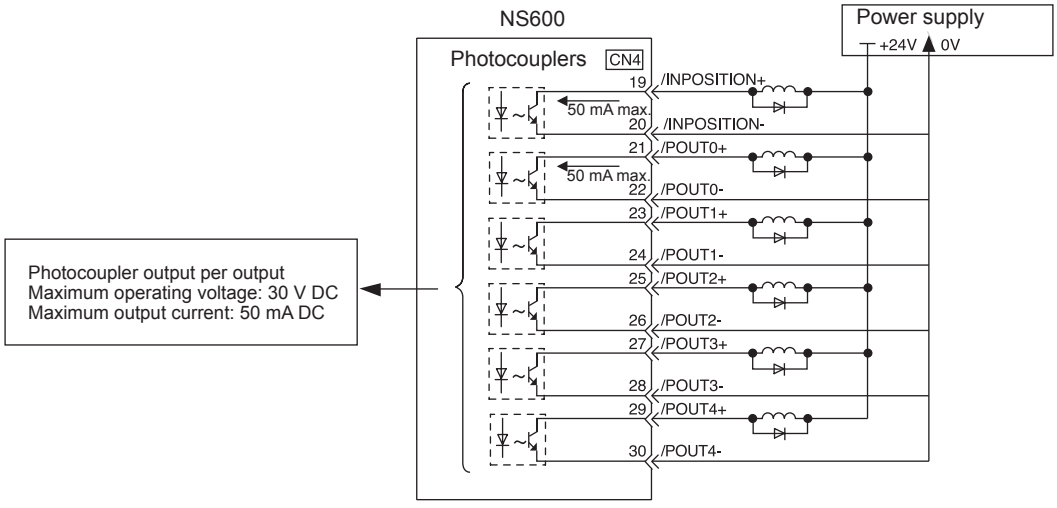
■ Output Signal Connections

Connect the sequence output signals as shown in the following figure.

CN1 Connector



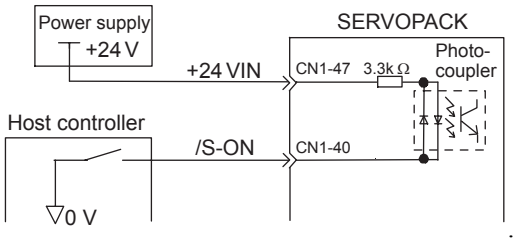
CN4 Connector



IMPORTANT

Provide a separate external I/O power supply; the SERVOPACK and NS600 do not have an internal 24-V power supply. Yaskawa recommends using the same type of external power supply as that used for input circuits.

5.3.1 Using the Servo ON/OFF Input Signal (/S-ON)



→ Input /S-ON CN1-40	Servo ON

This signal is used to turn the servomotor ON and OFF.

Signal	Status	Operation
/S-ON	Photocoupler ON	Power is supplied to the servomotor.
	Photocoupler OFF	Power is not supplied to the servomotor. Do not turn the servo OFF while the servomotor is operating except in an emergency-stop situation.

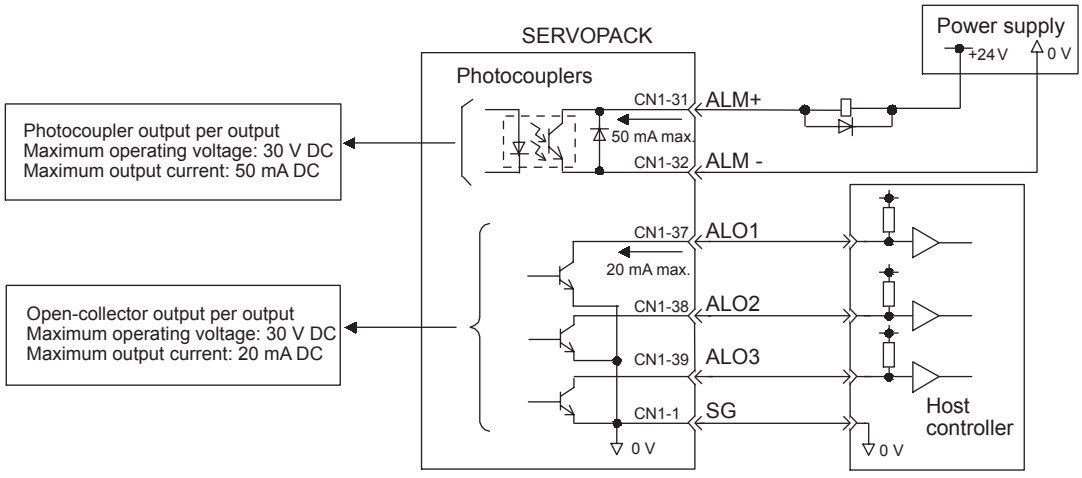
The /S-ON signal setting can be changed with parameter Pn80B.

Parame-ter	Signal	Pin No.	Settings	Factory Setting
Pn80B	/S-ON	CN1-40	0: Photocoupler ON = Servo ON 1: Photocoupler OFF = Servo ON 2: Servo is always ON. 3: Servo is always OFF.	0

5

5.3.2 Using Servo Alarm and Alarm Code Outputs (ALM, ALO1 to ALO3)

The basic procedure for connecting alarm output signals is described below.

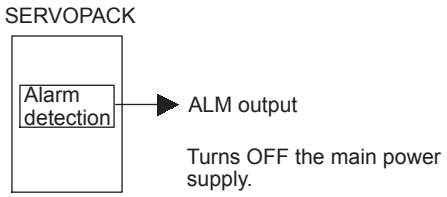


A suitable external I/O power supply must be provided by the user separately because there is no internal 24-V power supply in the SERVOPACK.

The use of the photocoupler output signals is described below.

Output → ALM+ CN1-31	Servo Alarm Output
Output → ALM- CN1-32	Signal Ground for Servo Alarm Output

These alarms are output when a SERVOPACK alarm is detected.



Form an external circuit so this alarm output (ALM) turns the SERVOPACK OFF.

ON:	Circuit between CN1-31 and 32 is closed, and CN1-31 is at low level.	Normal state
OFF:	Circuit between CN1-31 and 32 is open, and CN1-31 is at high level.	Alarm state

Alarm codes ALO1, ALO2 and ALO3 are output to indicate each alarm type. The uses of open-collector output signals ALO1, ALO2 and ALO3 is described below.

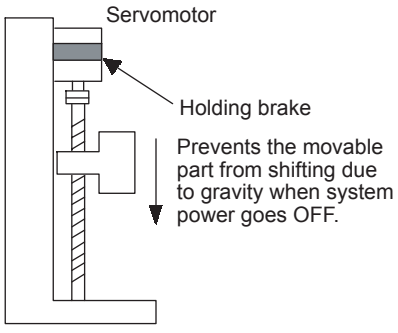
Output → ALO1 CN1-37	Alarm Code Output
Output → ALO2 CN1-38	Alarm Code Output
Output → ALO3 CN1-39	Alarm Code Output
Output → SG CN1-1	Signal Ground for Alarm Code Output

These signals output alarm codes to indicate the type of alarm detected by the SERVOPACK. Use these signals to display alarm codes at the host controller.

See *9.1.1 Alarm Display Table* for more details on the relationship between NS600 alarm display and alarm code output. See *9.2.2 Alarm Display Table* for more details on the relationship between SERVOPACK alarm display and alarm code output.

5.3.3 Brake Interlock Output Signal (/BK)

The holding brake is used when a servodrive controls a vertical axis. In other words, a servomotor with brake prevents the movable part from shifting due to gravity when system power goes OFF.

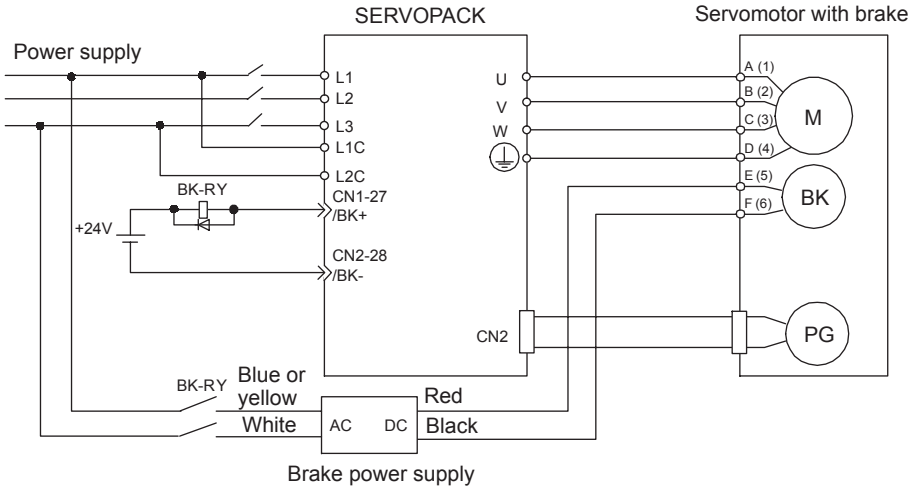


IMPORTANT

The brake built into the SGM□H servomotor with brakes is a de-energization brake, which is used only to hold and cannot be used for braking. Use the holding brake only to hold a stopped motor. Brake torque is at least 120% of the rated motor torque.

■ Wiring Example

Use the SERVOPACK contact output signal /BK and the brake power supply to form a brake ON/OFF circuit. The following diagram shows a standard wiring example.



BK-RY: Brake control relay

Output → /BK	Brake Interlock Output

This output signal controls the brake when using a servomotor with a brake and does not have to be connected when using a servomotor without a brake.

ON:	Photocoupler ON	Releases the brake.
OFF:	Photocoupler OFF	Applies the brake.

The /BK signal setting can be changed with parameter Pn817.

Parame-ter	Signal	Pin No.	Settings	Factory Setting
Pn817	/BK	CN1-27, CN1-28	0: Photocoupler ON = Releases the brake 1: Photocoupler OFF = Releases the brake	0

Related Parameters

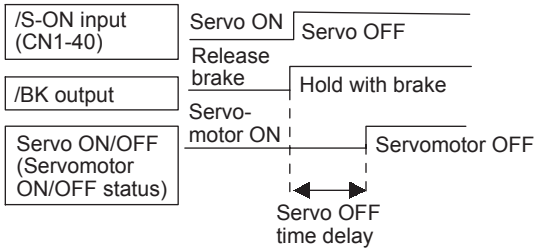
Pn506	Time Delay from Brake Reference until Servo OFF
Pn507	Speed Level for Brake Reference Output during Motor Operation
Pn508	Timing for Brake Reference Output during Motor Operation

■ Brake ON Timing

If the equipment moves slightly due to gravity when the brake is applied, set the following parameter to adjust brake ON timing.

Pn506	Brake Reference Servo OFF Delay Time	Unit: 10 ms	Setting Range: 0 to 50	Factory Setting: 0

This parameter is used to set the output time from the brake control signal /BK until the servo OFF operation (servomotor output stop) when a servomotor with a brake is used.



With the factory setting, the servo is turned OFF when the /BK signal (brake operation) is output. The equipment may move slightly due to gravity depending on equipment configuration and brake characteristics. If this happens, use this parameter to delay servo OFF timing.

This setting sets the brake ON timing when the servomotor is stopped. Use Pn507 and Pn508 for brake ON timing during operation.

IMPORTANT

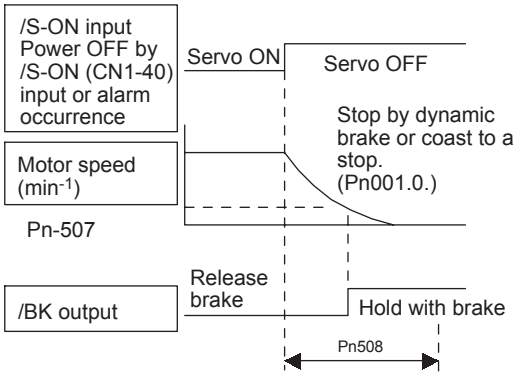
The servomotor will turn OFF immediately if an alarm occurs. The equipment may move due to gravity in the time it takes for the brake to operate.

■ Holding Brake Setting

Set the following parameters to adjust brake ON timing so the holding brake is applied when the servomotor stops.

Pn507	Brake Reference Output Speed Level	Unit: min^{-1}	Setting Range: 0 to 10,000	Factory Setting: 100
Pn508	Timing for Brake Reference Output during Motor Operation	Unit: 10 ms	Setting Range: 0 to 100	Factory Setting: 50

Set the brake timing used when the servo is turned OFF by input signal /S-ON (CN1-40) or when an alarm occurs during servomotor with brake operation.



Brake ON timing when the servomotor stops must be adjusted properly because servomotor brakes are designed as holding brakes. Adjust the parameter settings while observing equipment operation.

/BK Signal Output Conditions during Servomotor Operation

The circuit is open under either of the following conditions:

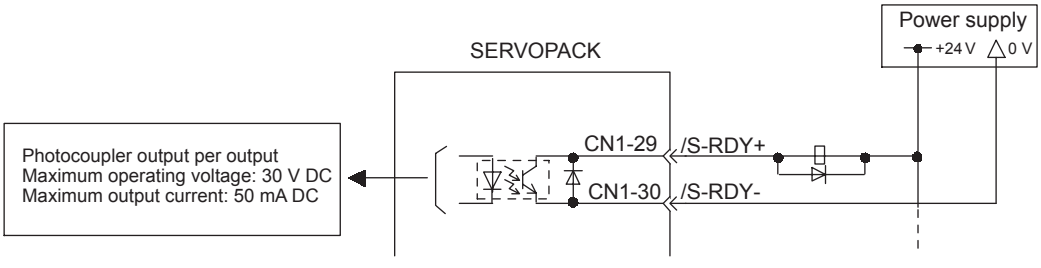
1	Motor speed drops below the setting at Pn507 after servo OFF.
2	The time set at Pn508 has elapsed since servo OFF.

The actual setting will be the maximum speed even if Pn507 is set higher than the maximum speed.

5.3.4 Using the Servo Ready Output Signal (/S-RDY)

The basic use and wiring procedures for the Servo Ready (/S-RDY) output signal (photocoupler output signal) are described below.

Servo Ready signal means there are no servo alarms and the main circuit power supply is ON, so the servo can be turned ON.



Output → /S-RDY CN1-29, CN1-30	Servo Ready Output Signal

This signal indicates the SERVOPACK received the Servo ON signal and completed all preparations.

ON:	Closed or low level	Servo is ready.
OFF:	Open or high level	Servo is not ready.

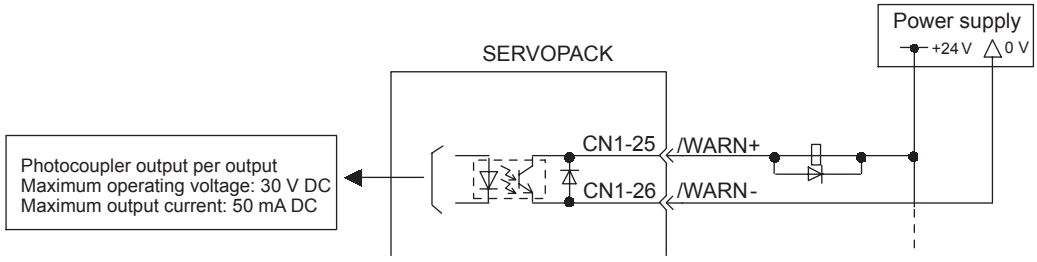
The /S-RDY signal setting can be changed with parameter Pn818.

Parameter	Signal	Pin No.	Settings	Factory Setting
Pn818	/S-RDY	CN1-29, CN1-30	0: Output closed = Servo Ready 1: Output open = Servo Ready	0

5.3.5 Using the Error/Warning Output Signal (/WARN)

The basic use and wiring procedure for the warning (/WARN) output signal (photocoupler output signal) are given below.

The warning output is composed from the following /WARN signals: NS600 Error, Overload Warning, Regenerative Overload Warning, and Low Battery Voltage Warning.



Output → /WARN CN1-25, CN1-26	Warning Output Signal

This output signal indicates an error or warning has occurred. If an error occurred, the output will last for 2 seconds; if a warning occurred, the output will remain until the cause of the warning has been eliminated.

OFF:	Open or high level	Normal operation
ON:	Closed or low level	Error or warning status (Overload, Regenerative Overload, Low Battery Voltage, or NS600 Error)

The /WARN output setting can be changed with parameter Pn816.

Parameter	Signal	Pin No.	Settings	Factory Setting
Pn816	/WARN	CN1-25, CN1-26	0: Output closed = Error or warning 1: Output open = Error or warning	0

The following parameter is used to output warning details with an alarm code.

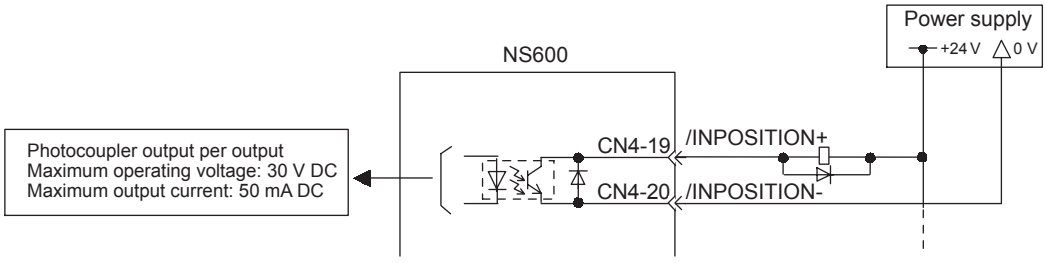
Pn001.3	Warning Code Output Selection	Factory Setting: 0

Pn001.3 Setting	Description
0	Outputs alarm codes alone for alarm codes ALO1, ALO2 and ALO3.
1	Outputs both alarm and warning codes for alarm codes ALO1, ALO2 and ALO3 and outputs an alarm code when an alarm occurs.

The following warning codes are output in 3 bits.

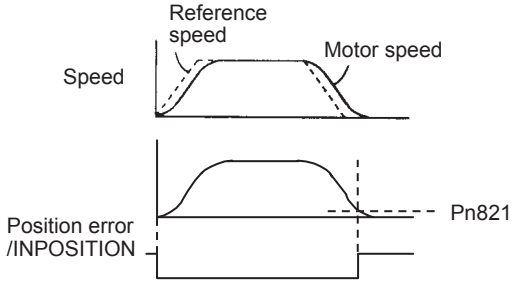
Warning Indication	Warning Code Output			Warning Description
	ALO1	ALO2	ALO3	
A.91	ON signal (low level)	OFF signal (high level)	OFF signal (high level)	Overload
A.92	OFF signal (high level)	ON signal (low level)	OFF signal (high level)	Regenerative overload
A.93	ON signal (low level)	ON signal (low level)	OFF signal (high level)	Low battery voltage

5.3.6 Using the Positioning Completed Output Signal (/INPOSITION)



Output → /INPOSITION	CN4-19, CN4-20	Positioning Completed Output Signal

This signal indicates that servomotor movement has been completed.



ON:	Circuit between CN4-19 and CN4-20 is closed.	Positioning is completed. (Position error is below the setting.)
OFF:	Circuit between CN4-19 and CN4-20 is open.	Positioning is not completed. (Position error is above the setting.)

The timing for output of the Positioning Completed Output can be adjusted by adjusting the INPOSITION Width with parameter Pn821.

Pn821	/INPOSITION Width	Unit: Reference units	Setting Range: 0 to 99,999	Factory Setting: 1

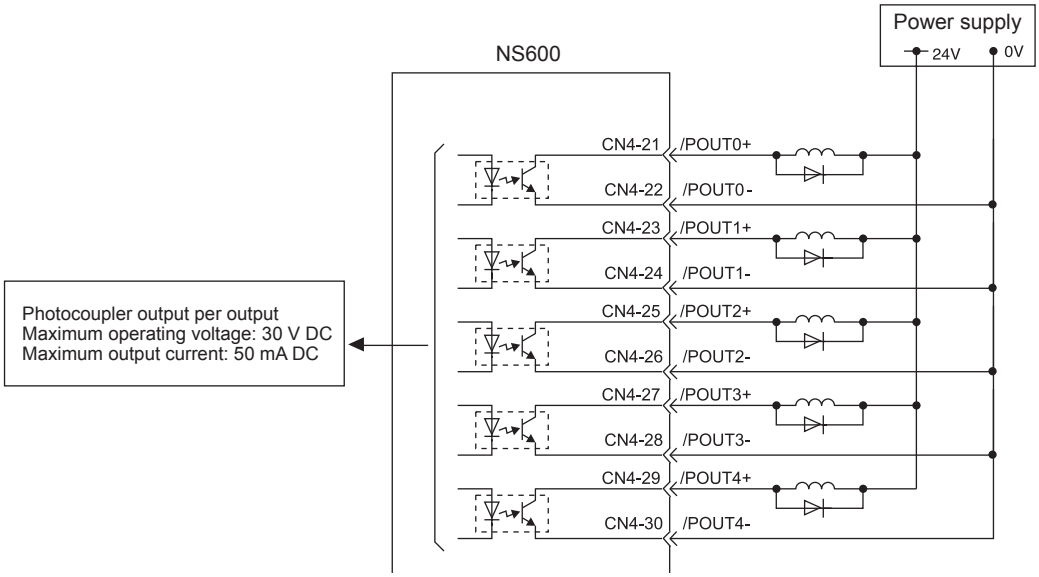
This parameter sets the output timing between completion of motor positioning and the output of the positioning completed output (/INPOSITION).

Input the set value in reference units.

The positioning completed width setting has no effect on final positioning accuracy.

5.3.7 Using the Programmable Output Signals (/POUT0 to /POUT4)

The basic use and wiring procedure for the Programmable Outputs (/POUT0 to /POUT4) are given below. The 5 Programmable Outputs can be changed by the user through the program table's POUT bits or the POUT serial command.



Output → /POUT0+ CN4-21 Output → /POUT0- CN4-22	Programmable Output 0
Output → /POUT1+ CN4-23 Output → /POUT1- CN4-24	Programmable Output 1
Output → /POUT2+ CN4-25 Output → /POUT2- CN4-26	Programmable Output 2
Output → /POUT3+ CN4-27 Output → /POUT3- CN4-28	Programmable Output 3
Output → /POUT4+ CN4-29 Output → /POUT4- CN4-30	Programmable Output 4

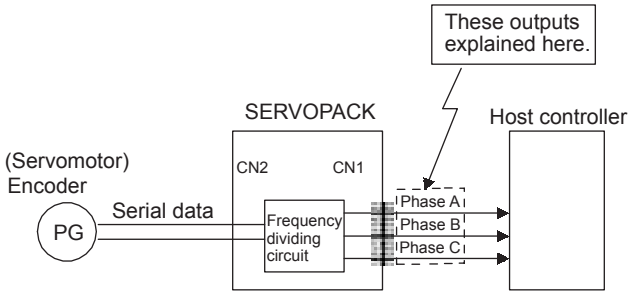
Status of /POUT0 to /POUT4	Status
ON	Output closed (low level)
OFF	Output open (high level)

Parameters Pn811 to Pn815 set the output status for /POUT0 to /POUT4, as shown in the following table.

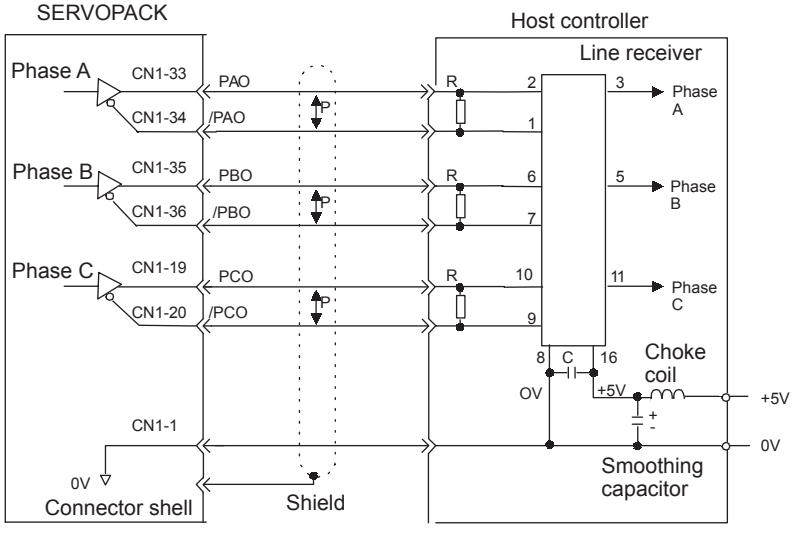
Parame-ter	Signal	Pin No.	Settings	Factory Setting
Pn811	/POUT0	CN4-21, CN4-22	0: Output closed = Active 1: Output open = Active	0
Pn812	/POUT1	CN4-23, CN4-24		
Pn813	/POUT2	CN4-25, CN4-26		
Pn814	/POUT3	CN4-27, CN4-28		
Pn815	/POUT4	CN4-29, CN4-30		

5.3.8 Encoder Signal Outputs

The encoder signals can be used to monitor the servomotor's speed and position. However, the NS600 manages the servomotor's speed and position so it isn't necessary to use the encoder signals to monitor the speed and position from the host controller.



The output circuit is for line-driver output. Connect each signal line according to the following circuit diagram.



P: represents twisted-pair wires.

Applicable line receiver:
SN75175 manufactured by Texas Instruments Inc., MC3486 or the equivalent.

R (terminator): 220 to 470 Ω
C (decoupling capacitor): 0.1 μF

■ I/O Signals

I/O signals are described below.

Output → PAO CN1-33	Encoder Output Phase A
Output → /PAO CN1-34	Encoder Output Phase /A
Output → PBO CN1-35	Encoder Output Phase B
Output → /PBO CN1-36	Encoder Output Phase /B
Output → PCO CN1-19	Encoder Output Phase C
Output → /PCO CN1-20	Encoder Output Phase /C
Output → SG CN1-1	Signal Ground

Divided encoder signals are output.

Set a dividing ratio at the following parameter.

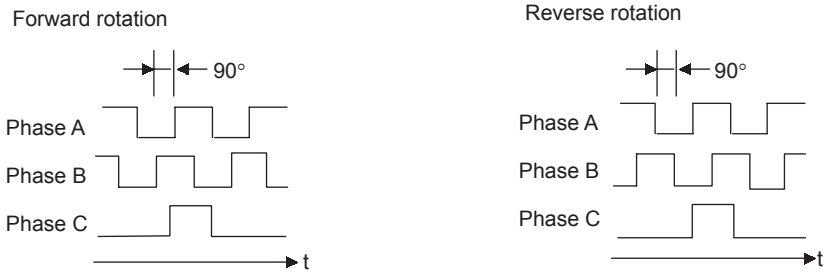
PG Dividing Ratio	Pn201

The dividing ratio setting is not related to the gear ratio setting (Pn202 and 203) for the SERVOPACK electronic gear function during position control.

INFO

Dividing is the process that takes the pulse data output from the encoder connected to the motor, converts that pulse data to the specified pulse density, and outputs the converted value. The units are pulses/revolution.

Output Phase Form



■ Pulse Divider Setting

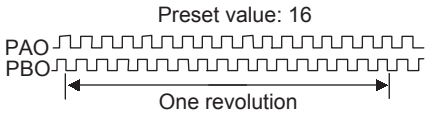
Set the pulse dividing ratio in the following parameter.

Pn201	PG Divider	Unit: P/R	Setting Range: 16 to 16,384	Factory Setting: 16,384	Speed/Torque Control, Position Control

The number of output pulses per revolution is set at this parameter.

The setting range varies with the encoder used.

Setting Example



Servomotor Model and Encoder Specifications	Resolution (Bits)	Number of Encoder Pulses Per Revolution (P/R)	Setting Range
A	13	2048 P/R	16 to 2048
B, 1	16	16384 P/R	16 to 16384
C, 2	17		

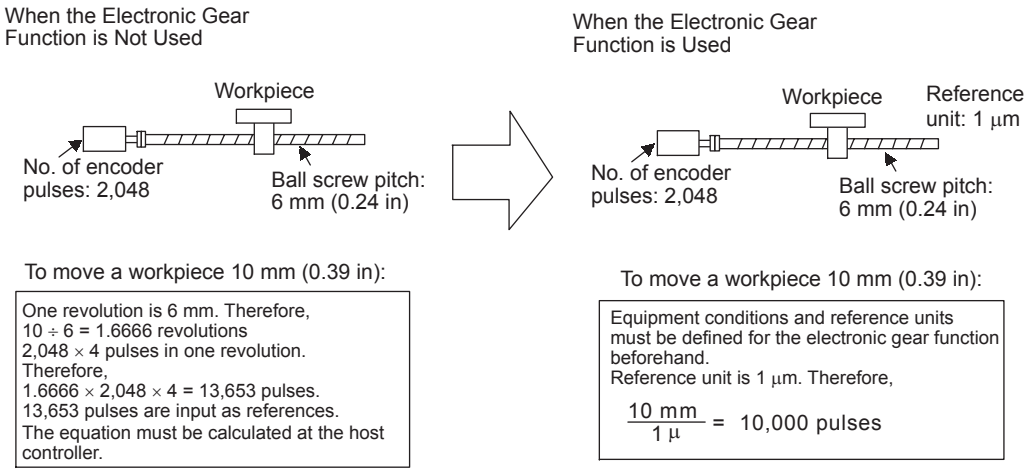
There are two phases, the PAO and PBO phases, and both phases are output at the dividing ratio so a resolution of the dividing ratio × 4 can be achieved if all of the edges of the PAO and PBO signals are counted. For example, 64 rising and falling edges can be counted if the dividing ratio is set to 16 pulses/revolution.

INFO

1. Turn OFF power once and turn ON again after changing the parameter.
2. A 13-bit encoder will run at 2048 P/R even if the setting at Pn201 is set higher than 2049.

5.4 Setting Reference Units

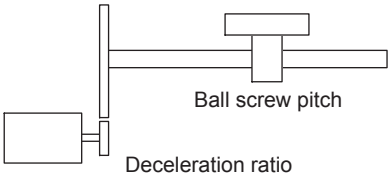
Reference units are the position and distance units that are used between the host controller and NS600. A reference unit is the minimum unit for positioning. The electronic gear ratio converts between reference units and encoder pulses.


When the Electronic Gear Function is Not Used
Workpiece
No. of encoder pulses: 2,048
Ball screw pitch: 6 mm (0.24 in)
When the Electronic Gear Function is Used
Workpiece
Reference unit: 1 μm
No. of encoder pulses: 2,048
Ball screw pitch: 6 mm (0.24 in)
To move a workpiece 10 mm (0.39 in):
One revolution is 6 mm. Therefore,
10 ÷ 6 = 1.6666 revolutions
2,048 × 4 pulses in one revolution.
Therefore,
1.6666 × 2,048 × 4 = 13,653 pulses.
13,653 pulses are input as references.
The equation must be calculated at the host controller.
To move a workpiece 10 mm (0.39 in):
Equipment conditions and reference units must be defined for the electronic gear function beforehand.
Reference unit is 1 μm. Therefore,
10 mm / 1 μ = 10,000 pulses

■ Setting Procedure of the Reference Unit

Calculate the electronic gear ratio (B/A) using the following procedure, and set the values in parameters Pn202 and Pn203.

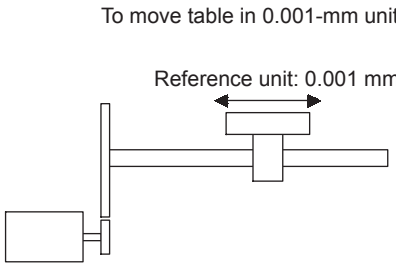
1. Check equipment specifications.
   Items related to the electronic gear:
   - Deceleration ratio
   - Ball screw pitch
   - Pulley diameter



2. Check the number of encoder pulses.

Servomotor Model and Encoder Specifications	Encoder Type	Number of Encoder Pulses Per Revolution (P/R)	
A	Incremental encoder	13-bit	2,048
B		16-bit	16,384
C		17-bit	32,768
1	Absolute encoder	16-bit	16,384
2		17-bit	32,768

3. Determine the reference unit to be used.



Determine the reference unit according to equipment specifications and positioning accuracy.

◀ EXAMPLE ▶

- 0.01 mm (0.0004 in), 0.001 mm, 0.1°, or 0.01 inch.
  A reference unit of one pulse moves the load by one reference unit.
- When the reference unit is 1 μm
  If a reference of 50,000 pulses is input, the load moves 50 mm (1.97 in) (50,000 × 1 μm).

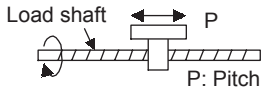
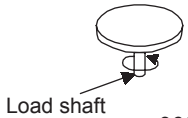
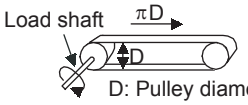
4. Determine the load travel distance per load shaft revolution in reference units.

$$\text{Travel distance per load shaft revolution (reference unit)} = \frac{\text{Travel distance per load shaft revolution}}{\text{Reference unit}}$$

◀ EXAMPLE ▶

- When the ball screw pitch is 5 mm (0.20 in) and the reference unit is 0.001 mm

$$\frac{5}{0.001} = 5000 \text{ (reference unit)}$$

Ball Screw	Disc Table	Belt and Pulley
 $1 \text{ revolution} = \frac{P}{\text{Reference unit}}$	 $1 \text{ revolution} = \frac{360°}{\text{Reference unit}}$	 $1 \text{ revolution} = \frac{\pi D}{\text{Reference unit}}$

5. Electronic gear ratio is given as $\left(\frac{B}{A}\right)$.

   If the decelerator ratio of the motor and the load shaft is given as $\frac{n}{m}$

   where m is the rotation of the motor and n is the rotation of the load shaft,

$$\text{Electronic gear ratio } \left(\frac{B}{A}\right) = \frac{\text{No. of encoder pulses} \times 4}{\text{Travel distance per load shaft revolution (reference unit)}} \times \frac{m}{n}$$

IMPORTANT

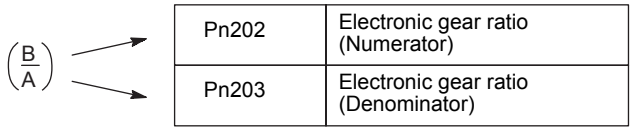
Make sure the electronic gear ratio satisfies the following condition:

$$0.01 \leq \text{Electronic gear ratio } \left(\frac{B}{A}\right) \leq 100$$

The SERVOPACK will not work properly if the electronic gear ratio is outside this range. In this case, modify the load configuration or reference unit.

6. Set the parameters.

   Reduce the electronic gear ratio $\left(\frac{B}{A}\right)$ to the lower terms so that both A and B are integers smaller than 65,535, then set A and B in the respective parameters.



This concludes the electronic gear ratio setting procedure.

Pn202	Electronic Gear Ratio (Numerator)	Unit: None	Setting Range: 1 to 65,535	Factory Setting: 4
Pn203	Electronic Gear Ratio (Denominator)	Unit: None	Setting Range: 1 to 65,535	Factory Setting: 1

Set the electronic gear ratio according to equipment specifications.

$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{Pn202}{Pn203}$$

- B = [(Number of encoder pulses) × 4] × [motor speed]
- A = [Reference units (travel distance per load shaft revolution)] × [load shaft revolution speed]

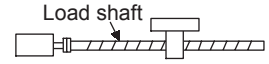
After changing parameter Pn202 or Pn203, turn the power OFF and then ON again.

■ Electronic Gear Setting Examples

The following examples show electronic gear settings for different load mechanisms.

Ball Screws

Reference unit: 0.001 mm



13-bit incremental encoder

Ball screw pitch: 6 mm (0.24 in)

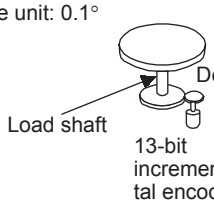
$$\text{Travel distance per load shaft revolution} = \frac{6\text{ mm}}{0.001\text{ mm}} = 6000$$

$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{2048 \times 4 \times 1}{6000 \times 1} = \frac{Pn202}{Pn203}$$

Preset Values	Pn202	8,192
	Pn203	6,000

Circular Tables

Reference unit: 0.1°



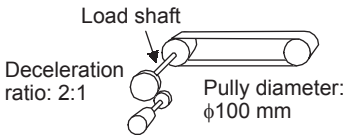
Travel distance per load shaft revolution $= \frac{360°}{0.1°} = 3600$

Electronic gear ratio $\left(\frac{B}{A}\right) = \frac{2048 \times 4 \times 3}{3600 \times 1} = \frac{Pn202}{Pn203}$

Preset Values	Pn202	24,576
	Pn203	3,600

Belts and Pulleys

Reference unit: 0.02 mm (0.0008 in)



Set a PG dividing ratio equivalent to 16 bit for the absolute encoder.

Travel distance per load shaft revolution $= \frac{3.14 \times 100 \text{ mm}}{0.02 \text{ mm}} = 15{,}700$

Electronic gear ratio $\left(\frac{B}{A}\right) = \frac{16{,}384 \times 4 \times 2}{15{,}700 \times 1} = \frac{Pn202}{Pn203}$

$= \frac{131{,}072}{15{,}700} = \frac{32{,}768}{3925}$

Preset Values	Pn202	32,768
	Pn203	3,925

5.4.1 Setting the Speed

Calculate the Positioning Speed.

◀ EXAMPLE ▶

- Reference unit: 0.01 mm (0.0004 in)
- Desired Positioning Speed: 15 m/min

$\frac{15{,}000 \text{ mm/min}}{0.01 \text{ mm}} = 1{,}500{,}000$ reference units/min

Thus, the Positioning Speed setting is 1,500 [× 1,000 reference units/min].

Specify the Positioning Speed and Registration Speed in the program table in SPD and RSPD.

Specify the Jog Speed in the Jog speed table in JSPD.

Specify the Positioning Speed and Registration Speed with the SPD and RSPD serial commands. The SPD and RSPD commands can be omitted; in this case, the setting in the following parameter will be used.

Pn81E	Positioning/Registration Speed	Setting Range: 1 to 99,999,999 (× 1,000 reference units/min)	Factory Setting: 1,000

5.4.2 Setting the Acceleration and Deceleration

Calculate the Acceleration/Deceleration.

◀ EXAMPLE ▶

- Reference unit: 0.01 mm (0.0004 in)
- Acceleration rate from 0 m/min to 15 m/min: 100 ms

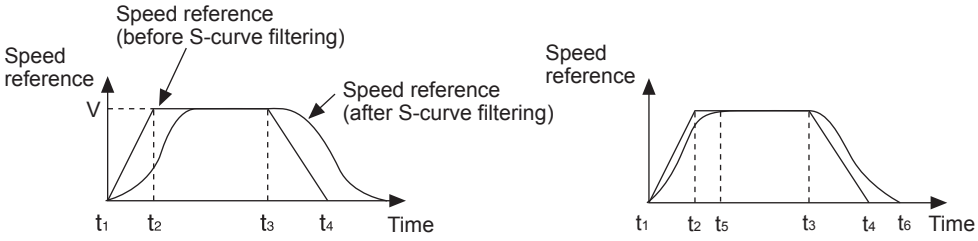
$$\frac{15{,}000 \text{ mm/min}}{0.01 \text{ mm}} = 1{,}500{,}000 \text{ reference units/min}$$

$$\frac{1{,}500{,}000 \text{ reference units/min}}{100 \text{ ms}} = 15{,}000 \text{ reference units/min/ms}$$

Thus, the Acceleration setting is 15 [× 1,000 reference units/min/ms].

Use the parameters listed in the following table to set the Acceleration and Deceleration rates.

Pn81F	Acceleration	Setting Range: 1 to 99,999,999 (×1,000 reference units/min/ms)	Factory Setting: 1,000
Pn820	Deceleration	Setting Range: 1 to 99,999,999 (×1,000 reference units/min/ms)	Factory Setting: 1,000
Pn208	S-curve Time	Setting Range: 0 to 6,400 (0.01 ms)	Factory Setting: 0



$$\text{Acceleration} = \frac{V}{t_2 - t_1} = \frac{[\times 1{,}000 \text{ reference units/min}]}{[\text{ms}]}$$

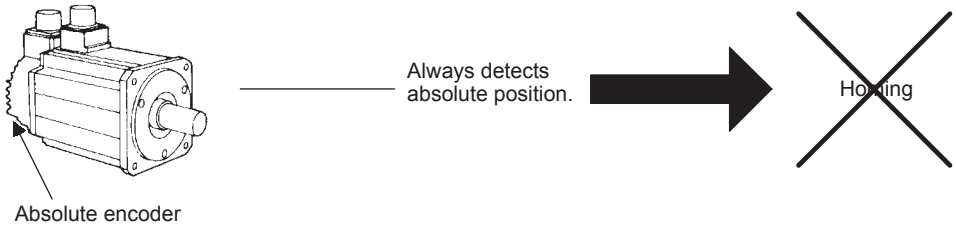
$$\text{Deceleration} = \frac{V}{t_4 - t_3} = \frac{[\times 1{,}000 \text{ reference units/min}]}{[\text{ms}]}$$

$$\text{S-curve time} = t_5 - t_2 = t_6 - t_4$$

5.5 Absolute Encoders

If a motor with an absolute encoder is used, operation can be restarted without performing the homing operation.

Motor SGM□H-□□□1□···With 16-bit absolute encoder
SGM□H-□□□2□···With 17-bit absolute encoder



⚠ WARNING

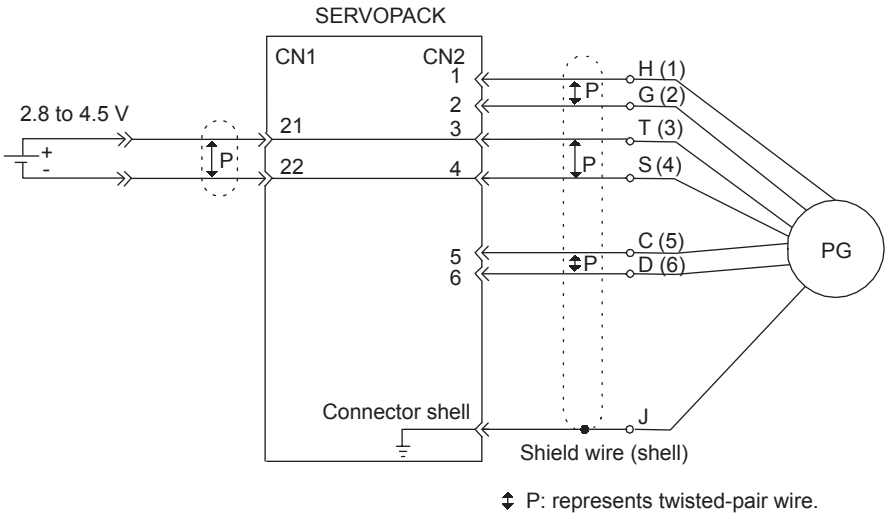
- The output range of multiturn data for Σ-II series absolute detection system differs from that for conventional systems (15-bit encoder and 12-bit encoder). Specially, when "Infinite length positioning system" of conventional type is to be configured with Σ-II series, be sure to make the following system modification.

Absolute Encoder Type	Output Range of Multiturn Data	Motion When Exceeds the Limit
Conventional Types (12-bit and 15-bit)	–99,999 to +99,999	• When exceeds the upper limit (+99999) in the positive direction, the multiturn data is 0. • When exceeds the lower limit (–99999) in the negative direction, the multiturn data is 0.
Σ-II Series (16-bit and 17-bit)	–32,768 to +32,767	• When exceeds the upper limit (+32767) in the positive direction, the multiturn data is –32768.* • When exceeds the lower limit (–32768) in the negative direction, the multiturn data is +32767.*

* When the multiturn limit setting (Pn205) is changed, the motion differs.
Refer to *5.5.5 Multiturn Limit Setting*.

5.5.1 Interface Circuit

The following diagram shows the standard connections for an absolute encoder mounted to a servomotor.



5.5.2 Selecting an Absolute Encoder

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0

"0" in the following table must be set to enable the absolute encoder.

Pn002.2 Setting	Contents
0	Use the absolute encoder as an absolute encoder.
1	Use the absolute encoder as an incremental encoder.

Note: This user definition goes into effect when the power is turned OFF after the change has been made.

5.5.3 Handling Batteries

In order for the absolute encoder to retain position data when the power is turned OFF, the data must be backed up by a battery. Provide the battery recommended below.

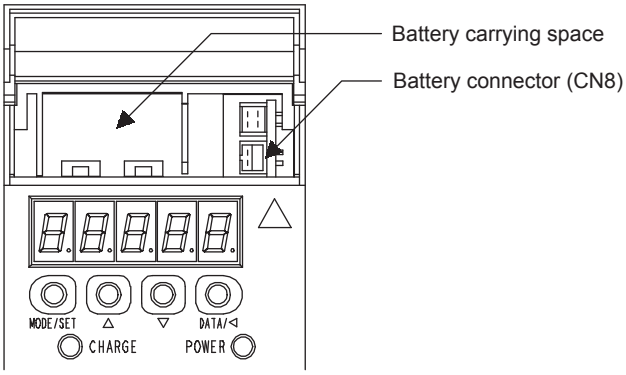
■ Installing the Battery at the Host Device (CN1-21, CN1-22)

Lithium battery, by Toshiba: ER6VC3, 3.6 V, 2,000 mAh

■ Battery Provided for SERVOPACK (CN8)

Lithium battery: JZSP-BA01 (includes battery and connector)

Battery: Toshiba, ER3 V, 3.6 V, 1,000 mAh



⃠ PROHIBITED

- Install the battery at either CN1-21/CN1-22 or CN8. It is dangerous to install batteries at both simultaneously, because that sets up a loop circuit between the batteries.

5.5.4 Absolute Encoder Setup (Initialization)

Perform the setup operation for the absolute encoder in the following circumstances:

- When starting the machine for the first time.
- When an encoder backup alarm is generated.
- When the SERVOPACK's power supply is turned OFF and the encoder's cable is removed.

The absolute encoder can be set up using Digital Operator function Fn008 or the ABSPGRES serial command. For more details, refer to *B.2 Auxiliary Functions*.

INFO

The absolute encoder setup operation is only possible when the servo is OFF. After the setup processing is finished, turn the power back ON again.

5.5.5 Multiturn Limit Setting

When implementing absolute detection system for machines that turn m times in response to n turns in the load shaft such as round tables, it is convenient to reset the multiturn data from the encoder to 0 every m turns. The Multiturn Limit[1] Setting allows the value m-1 to be set for the encoder.

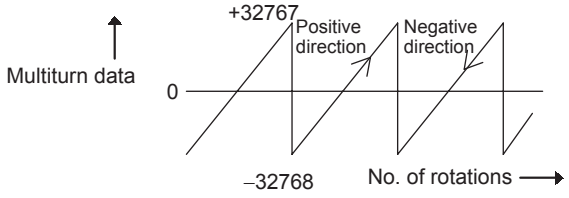
INFO Set the value "m-1" in the encoder if the motor turns "m" times.

The multiturn limit is set in the SERVOPACK using the following parameter.

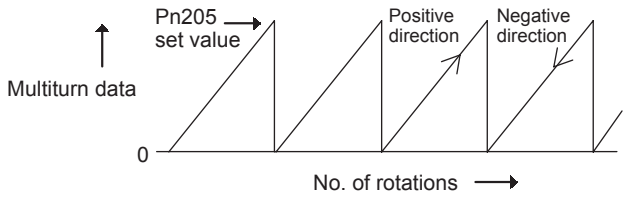
Pn205	Multiturn Limit Setting	Unit: rev	Setting Range: 0 to 65,535	Factory Setting: 65,535

If the Multiturn Limit Setting is set to 65,535 (factory setting), the multiturn data will vary from –32,768 to 32,767. If any other value is set, the multiturn data will vary from 0 to the setting of Pn205.

- Variation of multiturn data when the multiturn limit value is 65,535 (factory setting).



- Variation of multiturn data when the multiturn limit value is other than 65,535 (factory setting).



If the servomotor rotates in the negative direction from 0, the multiturn data will change to the value set for Pn205. If the servomotor rotates in the positive direction from the value set in Pn205, the multiturn data will change to 0. Set Pn205 to m-1.

INFO Turn the power OFF and then back ON after changing the setting of parameter Pn002.2 or Pn205.

TERMS

[1] Multiturn Limit

The multiturn limit is the upper limit of the multiturn data. If Pn002.2 = 0, the multiturn data will vary between 0 and the value set for Pn205 (Multiturn Limit Setting).

The multiturn limit value in the Encoder is factory set to 65,535, the same as the SERVOPACK. If the multiturn limit value in the SERVOPACK is changed with Pn205 and then the SERVOPACK power is turned OFF and ON, the following alarm will occur.

Alarm Name: Multiturn Limit Disagreement

Alarm Display	Alarm Code Outputs			Meaning of Alarm
	ALO1	ALO2	ALO3	
A.CC	ON	OFF	ON	The multiturn limit value is different in the Encoder and SERVOPACK.

Note: ON signals are low level; OFF signals are high level.

When this alarm occurs, the multiturn limit in the Encoder must be changed. This setting can be changed with Digital Operator function Fn013 (the Auxiliary Function Mode) or the MLTLIMSET serial command.

The multiturn limit setting in the Encoder can be changed only when the Multiturn Limit Disagreement alarm has occurred. After changing the setting, turn the power supply OFF and then back ON.

5.6 Program Table

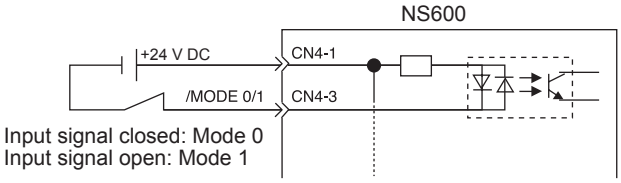
5.6.1 Mode Switch Signal (/MODE 0/1)

If the /MODE 0/1 input signal is active, the mode is set to program table operation mode (Mode 0). Parameter Pn803 sets the relationship between the signal's ON/OFF status and its active/inactive status.

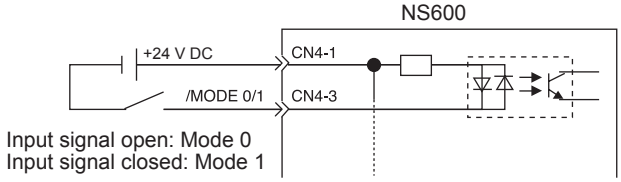
Parame-ter	Signal	Pin No.	Settings	Factory Setting
Pn803	/MODE 0/1	CN4-3	0: Photocoupler ON = Mode 0 1: Photocoupler OFF = Mode 0 2: Always Mode 0 3: Always Mode 1	0

◀ EXAMPLE ▶

- Pn803 = 0



- Pn803 = 1



5.6.2 Input Signals for Program Table Operation

Set input signals with the following parameters.

Parameter	Signal	Pin No.	Settings	Factory Setting
Pn804	/START-STOP	CN4-5	0: Photocoupler ON = Program table operation start. Photocoupler OFF = Program table operation stop. 1: Photocoupler OFF = Program table operation start. Photocoupler ON = Program table operation stop. 2 or 3: Do not start program.	0
Pn805	/PGMRES	CN4-7	0: Photocoupler OFF-to-ON = Cancel program. 1: Photocoupler ON-to-OFF = Cancel program. 2 or 3: Do not cancel program.	0
Pn806	/SEL0	CN4-9	0: Photocoupler ON = Active 1: Photocoupler OFF = Active 2: Always Active 3: Always Inactive	0
Pn807	/SEL1	CN4-11		
Pn808	/SEL2	CN4-13		
Pn809	/SEL3	CN4-15		
Pn80A	/SEL4	CN4-17		
Pn833	/SEL5	CN4-41		
Pn834	/SEL6	CN4-45		

The wiring and parameter settings described in the table above are not necessary when program table operations are performed with serial commands. The following table shows which serial commands correspond to the various input signals.

Signal	Corresponding Serial Command
/MODE 0/1	None (Mode switching is not necessary.)
/START-STOP /SEL0 to /SEL6	Start: START □□□ command (□□□ = 000 to 127) Stop: STOP command Restart: START command
/PGMRES	PGMRES command

5.6.3 Program Table Step Selection

Use the 7-bit selection signals (/SEL0 to /SEL6) to specify PGMSTEP 0 to 127.

PGMSTEP	Selection Signal Status						
	/SEL6	/SEL5	/SEL4	/SEL3	/SEL2	/SEL1	/SEL0
0	---	---	---	---	---	---	---
1	---	---	---	---	---	---	Active
2	---	---	---	---	---	Active	---
3	---	---	---	---	---	Active	Active
4	---	---	---	---	Active	---	---
5	---	---	---	---	Active	---	Active
6	---	---	---	---	Active	Active	---
7	---	---	---	---	Active	Active	Active
8	---	---	---	Active	---	---	---
9	---	---	---	Active	---	---	Active
10	---	---	---	Active	---	Active	---
11	---	---	---	Active	---	Active	Active
12	---	---	---	Active	Active	---	---
13	---	---	---	Active	Active	---	Active
14	---	---	---	Active	Active	Active	---
15	---	---	---	Active	Active	Active	Active
16	---	---	Active	---	---	---	---
				:			
				:			
126	Active	Active	Active	Active	Active	Active	---
127	Active	Active	Active	Active	Active	Active	Active

Note: The “---” symbols indicate an inactive input status and “Active” indicates an active input status.

5.6.4 Program Table Settings

This section explains the program table settings.

■ Program Table

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0								
1								
2								
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
127								

■ Program Table Functions

The following table shows the various program table functions.

Table 5.2 Program Table Functions

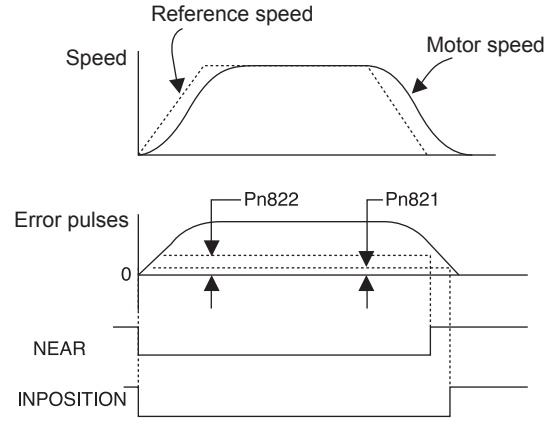
Item	Function	Description
PGMSTEP	Program step	Number of usable program steps: 128 (0 to 127) The program step can be specified with NEXT.
POS	Target position	I +/–99,999,999 Relative position (travel distance) specification [reference units] A +/–99,999,999 Absolute position specification [reference units] +INFINITE: Jog forward operation (See note.) -INFINITE: Jog reverse operation (See note.) STOP: Stop (for use with +/-INFINITE operation) -: No positioning specified (for POUT only) (The factory setting is STOP.) Note: The +INFINITE and -INFINITE settings can be used only when the rotary coordinates have been set (Pn81A = 1, 2, or 3) or software limits are not being used (Pn81B = Pn81C = 0). An error will occur if linear coordinates are being used or a software limit is enabled.
SPD	Positioning speed	1 to 99,999,999: Positioning speed [× 1,000 reference units/min] (The factory setting is 1,000.)
RDST	Registration distance	0 to 99,999,999: Registration distance [reference units] -: No registration (The factory setting is "-" for no registration.)
RSPD	Registration speed	1 to 99,999,999: Registration speed [× 1,000 reference units/min] (The factory setting is 1,000.)

Table 5.2 Program Table Functions (cont'd)

<table>
<tr><th>Item</th><th>Function</th><th>Description</th></tr>
<tr><td>POUT</td><td>Programmable output signals</td><td>nnnnn n = N, A, Z, :
/POUT0 N: Inactive
/POUT1 A: Active
/POUT2 Z: ZONE signal (ZONE table reference)
/POUT3
/POUT4 : : Retain previous status.

When execution of a step is started, the corresponding output signal (/POUT0 to /POUT4) is output.If you want to output the signal at the end of the step, specify POUT as POS = "-" in the next step.</td></tr>
<tr><td>EVENT</td><td>Positioning completed judgement</td><td>The LOOP is the process from the start of positioning until the EVENT.
Conditions:

I: /INPOSITION
N: NEAR

The following parameters set the INPOSITION and NEAR detection widths.
<table><tr><td>Pn821</td><td>INPOSITION Width</td><td rowspan="2">Setting Range:
0 to 99,999</td><td rowspan="2">Factory Setting:
1</td></tr><tr><td>Pn822</td><td>Near Width</td></tr></table> 

D DEN position reference distribution completed
SELx (x = 0 to 6) Input signal (/SEL0 to /SEL6) active.
(Level detection is used, not edge detection.)
Tn (n = 0 to 99,999) Time elapsed (ms) since the program step started.
: Continue the previously executed step's specification.

Note: The I, N, D, and SELx parameters can be combined with Tn.

ITn Waits for n ms after INPOSITION becomes active.
NTn Waits for n ms after NEAR becomes active.
DTn Waits for n ms after DEN becomes active.
SEL x Tn Waits for n ms after SELx becomes active.
(The factory setting is IT0.)
Note: Refer to 5.6.5 Examples of Event Conditions if necessary.</td></tr>
</table>

Table 5.2 Program Table Functions (cont'd)

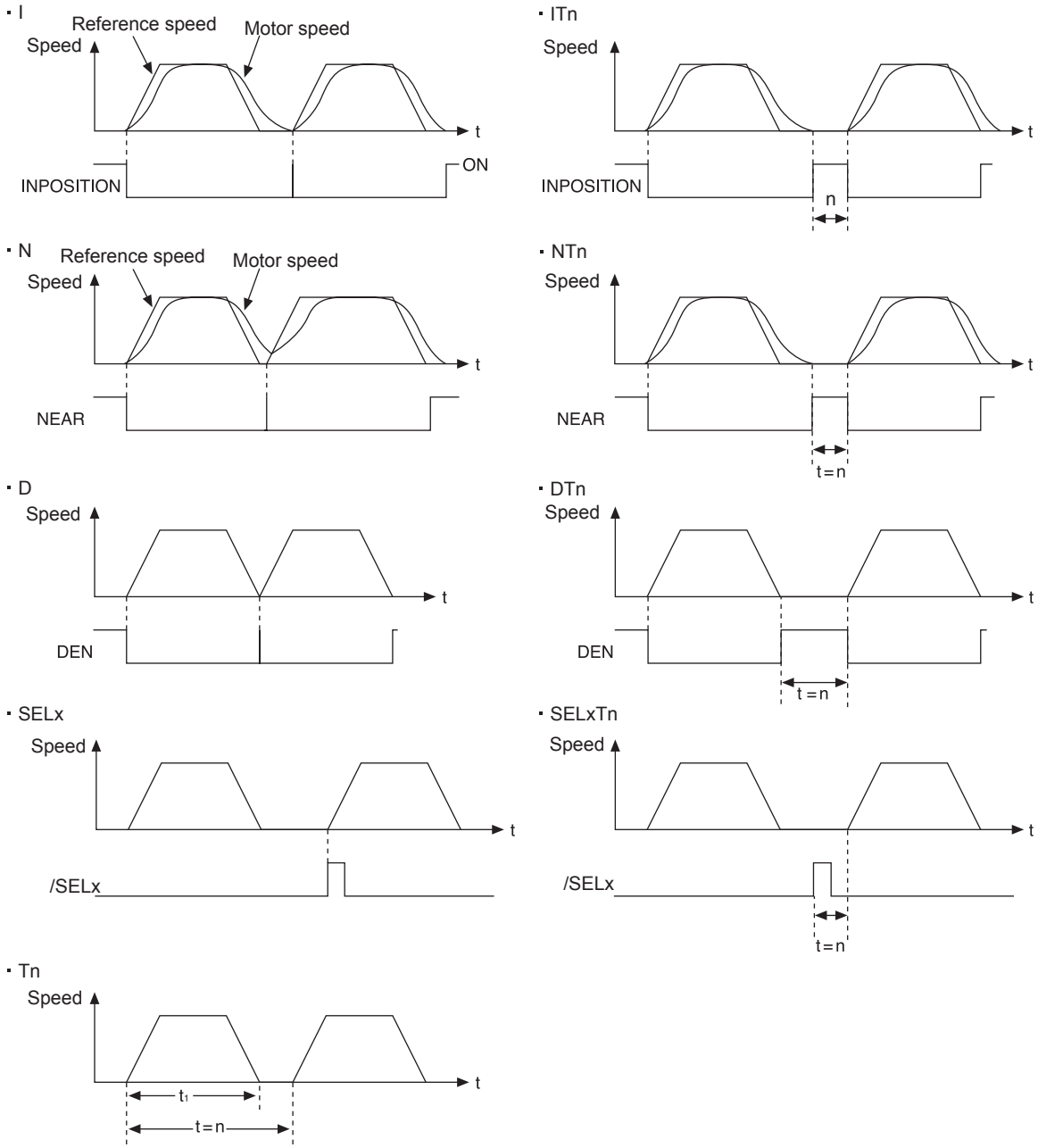
Item	Function	Description
LOOP	Number of executions	Specifies how many times to repeat execution of the processing from the start of positioning until the EVENT. Setting range: 1 to 99,999 (The factory setting is 1.)
NEXT	PGMSTEP to be executed next	n (n = 0 to 127) Jump to the specified PGMSTEP. END End program table operation. (The factory setting is END.) Note: The NEXT parameter is referenced after the number of LOOP repetitions are completed. The LOOP specification cannot apply to more than one PGMSTEP.

Note: 1. An error (E53E) will occur and program table operation will be stopped if a new positioning command is received during positioning. To restart, turn the /START-STOP signal OFF and then ON again.

2. When the target position is +INFINITE or -INFINITE, the PGMSTEP can be switched and the speed can be changed. In this case, the motor will shift to the new speed.

5.6.5 Examples of Event Conditions

The following figures show examples of event conditions.

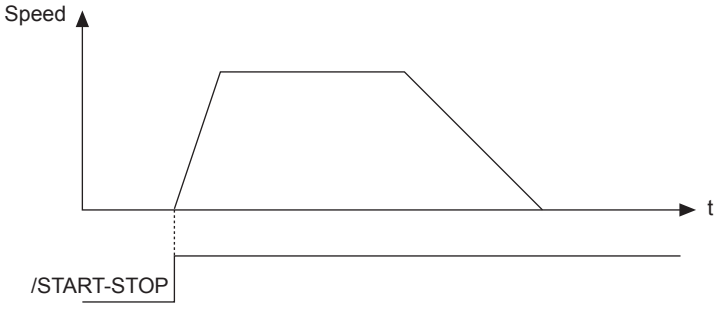


Note: If $t < t_1$, an error (E53E) will occur and program table operation will be stopped.

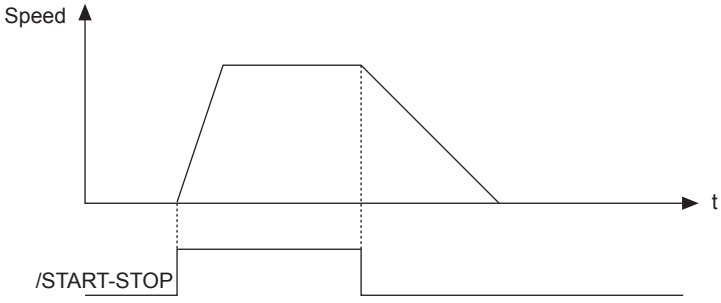
5.6.6 Program Table Operation

■ Starting and Stopping the Program

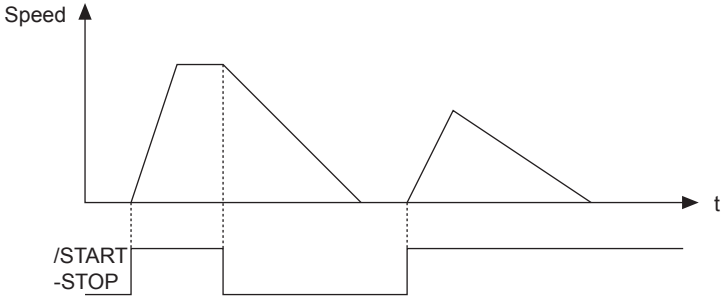
If the /START-STOP signal becomes active, the program will be executed from the PGM-STEP specified with /SEL0 to /SEL6.



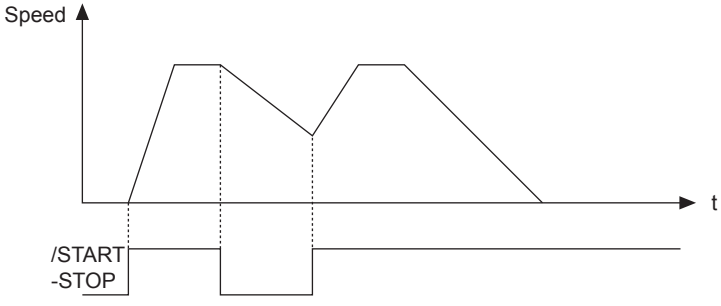
If the /START-STOP returns to inactive status, the program will be stopped and the motor will stop (positioning will be stopped).



If the /START-STOP becomes active again while the program is stopped, the program (positioning) will be restarted.



The program will be restarted even if the motor is decelerating.

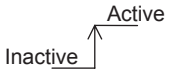
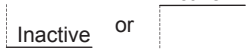
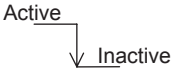
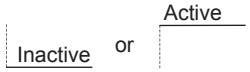
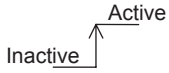
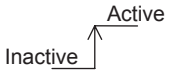
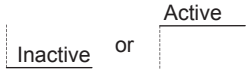


■ Resetting the Program

The program will be cancelled if the /PGMRES signal becomes active after the program was stopped (the /START-STOP signal became inactive). Once the program has been cancelled, it will be executed from the PGMSTEP specified with /SEL0 to /SEL6 if the /START-STOP signal becomes active again.

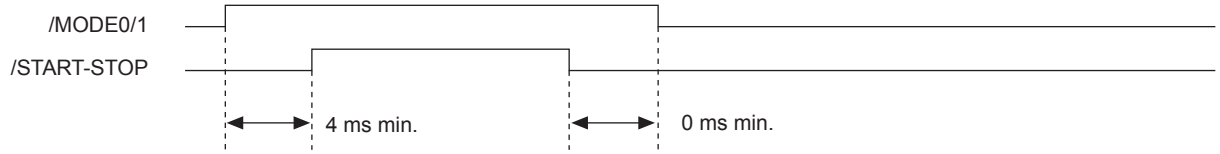
5.6.7 Status Changes in Program Table Operation

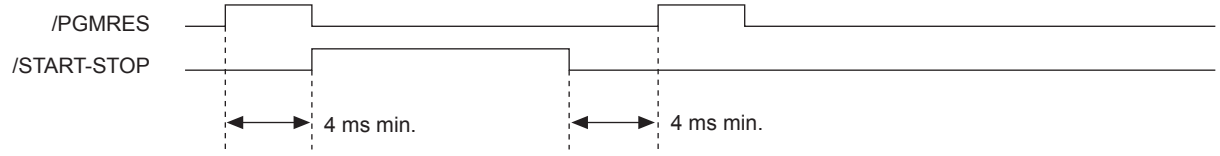
The following table shows the status changes that can occur during program table operation.

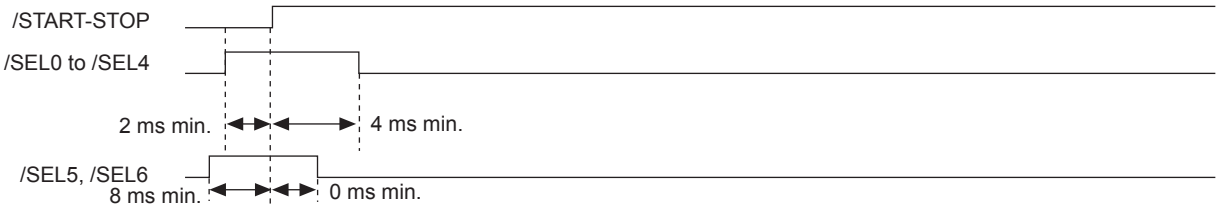
Status	/START-STOP	/PGMRES	Operation
Cancelled			Start (Latch specified signal between /SEL0 and /SEL6.)
Executing (Started or restarted)			Stop
Stopped			Cancel
			Restart

5.6.8 Input Signal Timing Specifications for Program Table Operation

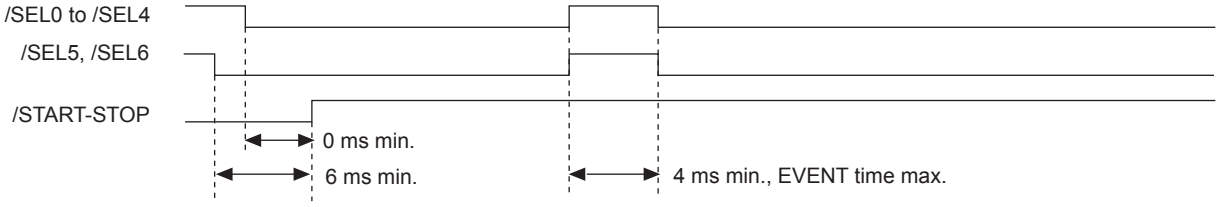
The following figures show the timing specifications of program table input signals.







- When /SEL0 to /SEL6 are specified in EVENT

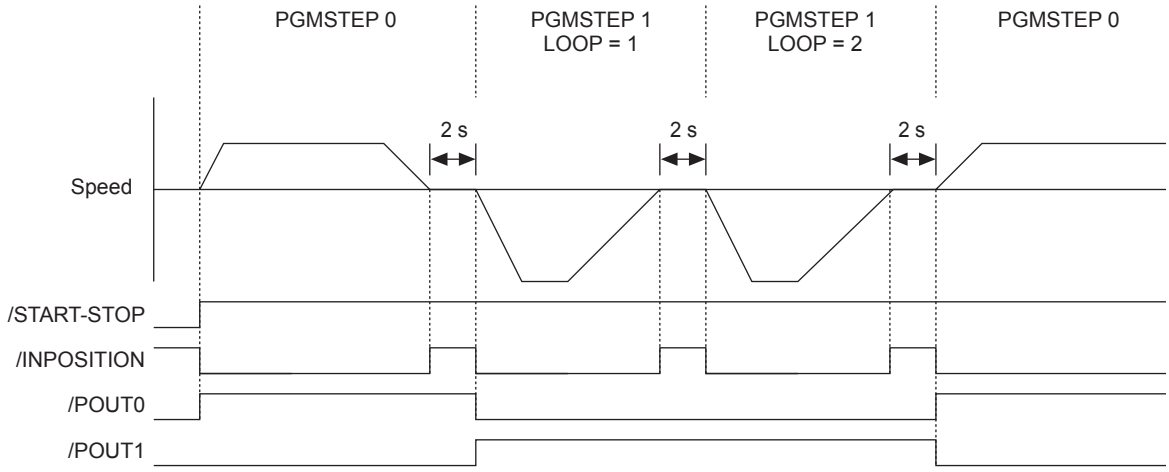


5.6.9 Program Table Examples

This section provides representative examples of program tables.

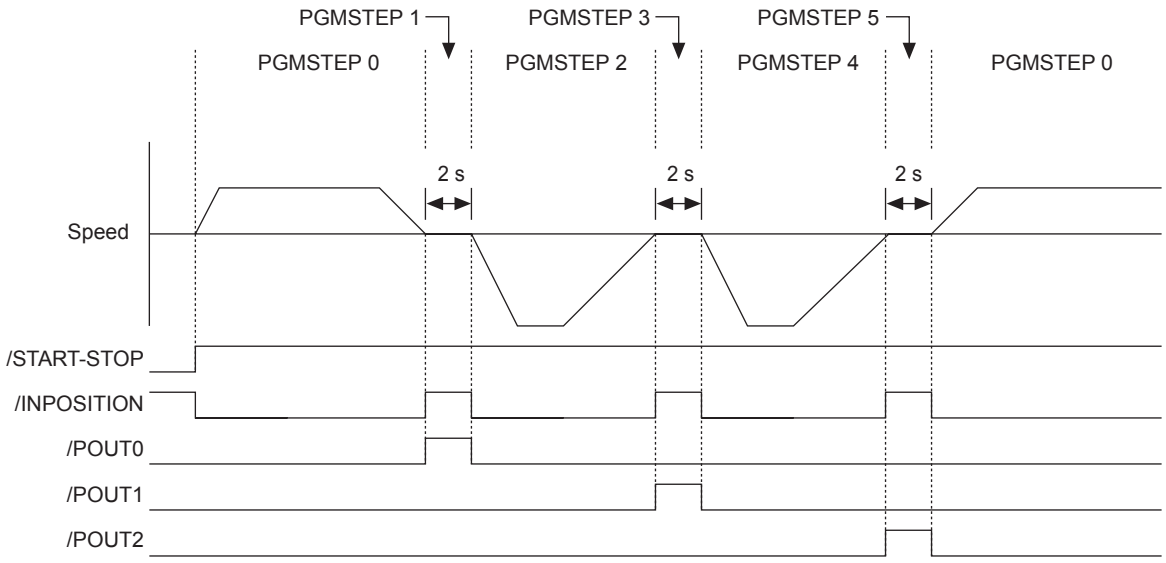
■ Simple Round-trip Operation

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNA	IT2000	1	1
1	I–200000	30000	-	1000	NNNAN	IT2000	2	0



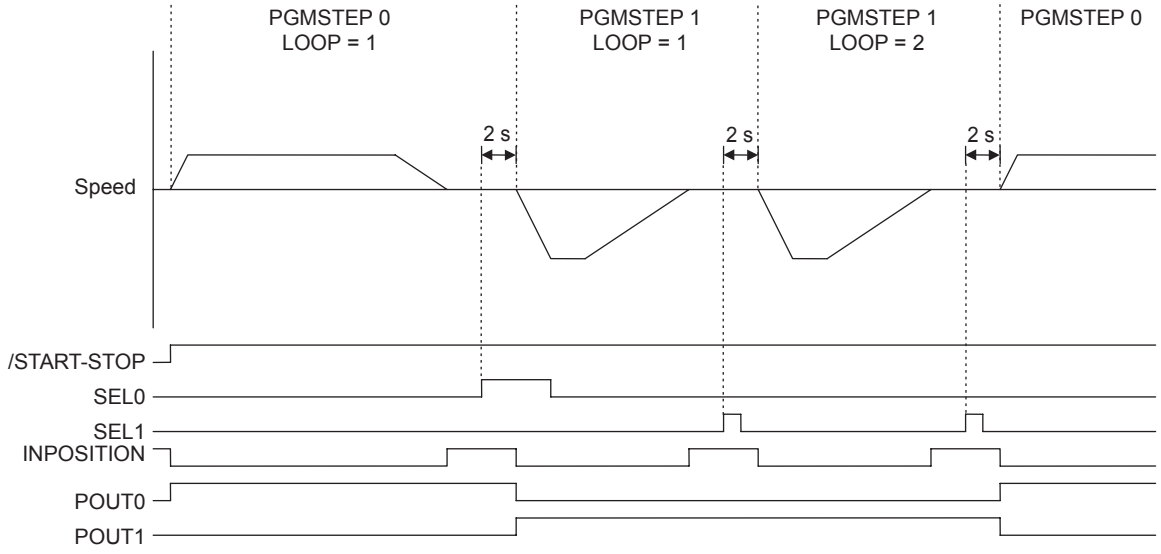
■ Output /POUTx Signal for 2 Seconds after Positioning Completed

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNN	IT0	1	1
1	-	15000	-	1000	: : : : A	T2000	1	2
2	I–200000	30000	-	1000	NNNNN	IT0	1	3
3	-	30000	-	1000	: : : A :	T2000	1	4
4	I–200000	30000	-	1000	NNNNN	IT0	1	5
5	-	30000	-	1000	: : A : :	T2000	1	0



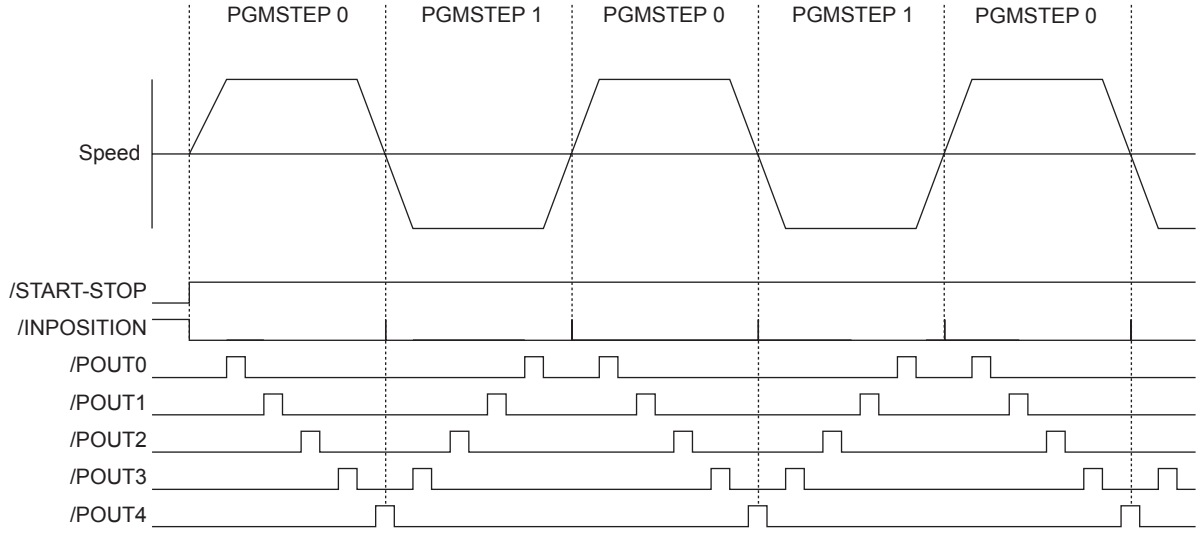
■ Using a /SELx Signal in an EVENT

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNA	SEL0T2000	1	1
1	I–200000	30000	-	1000	NNNAN	SEL1T2000	2	0



■ Using a ZONE Table

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	A+500000	30000	-	1000	ZZZZZ	IT0	1	1
1	A+000000	30000	-	1000	ZZZZZ	IT0	1	0



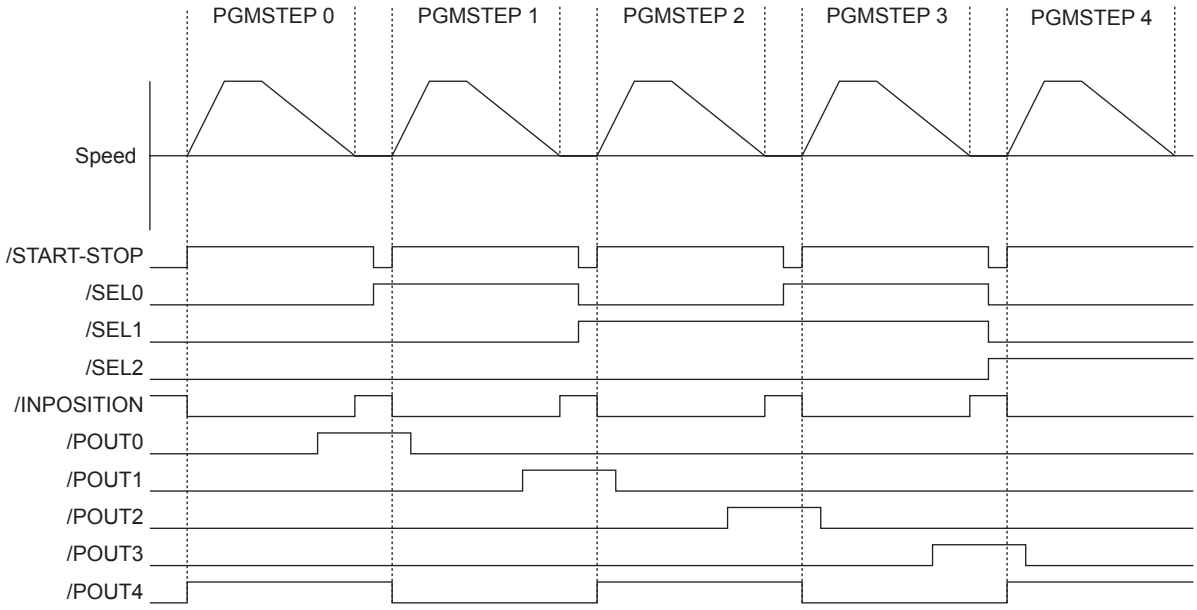
ZONE Table

	ZONEN	ZONEP
0	0	0
1	+099995	+100004
2	+199995	+200004
3	0	0
4	+299995	+300004
5	0	0
6	0	0
7	0	0
8	+399995	+400004
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0

	ZONEN	ZONEP
16	+499995	+500004
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0

■ Using a Positioning Table

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	A+000000	30000	-	1000	AZZZZ	IT0	1	END
1	A+100000	30000	-	1000	NZZZZ	IT0	1	END
2	A+200000	30000	-	1000	AZZZZ	IT0	1	END
3	A+300000	30000	-	1000	NZZZZ	IT0	1	END
4	A+400000	30000	-	1000	AZZZZ	IT0	1	END



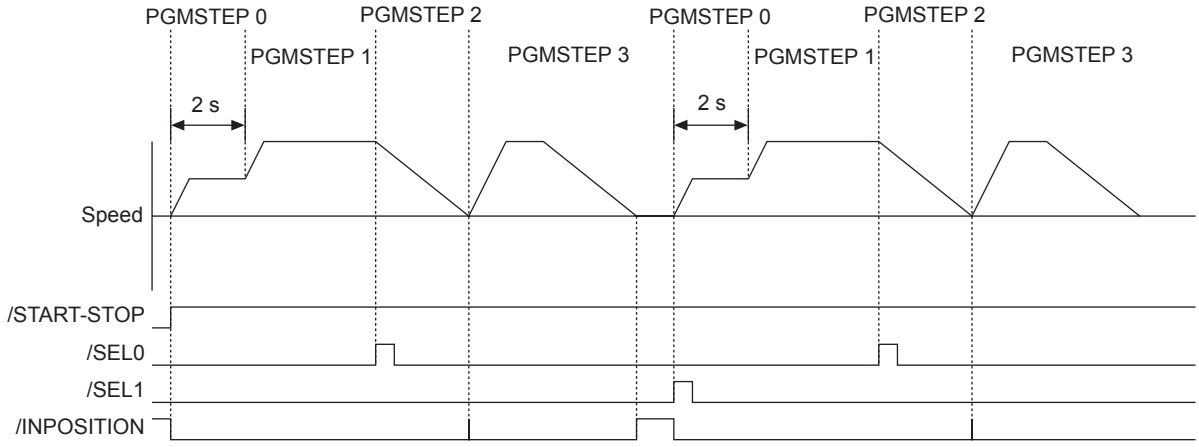
Zone Table

	ZONEN	ZONEP
0	0	0
1	–001000	+001000
2	+099000	+101000
3	0	0
4	+199000	+201000
5	0	0
6	0	0
7	0	0
8	+299000	+301000
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0

	ZONEN	ZONEP
16	+399000	+401000
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0

■ Using the INFINITE Parameter

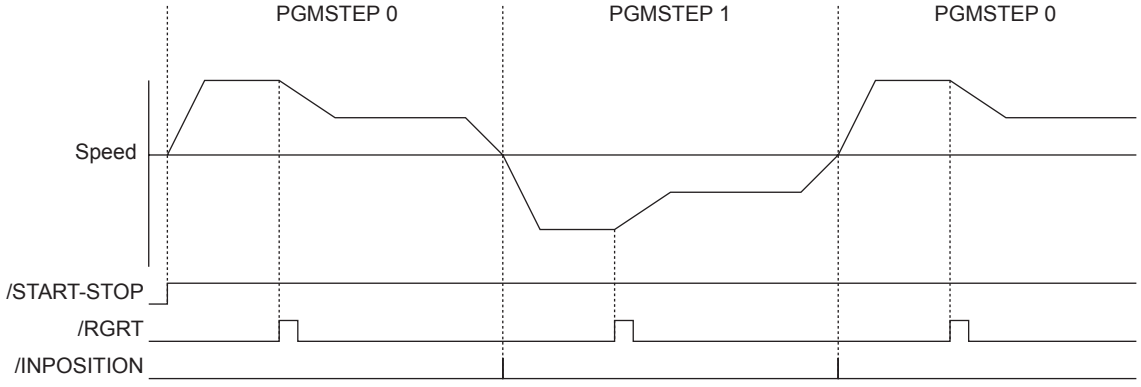
PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	+INFINITE	15000	-	1000	NNNNN	T2000	1	1
1	+INFINITE	30000	-	1000	: : : : :	SEL0TO	1	2
2	STOP	30000	-	1000	: : : : :	IT0	1	3
3	A+400000	30000	-	1000	: : : : :	SEL1TO	1	0



■ Using Registration

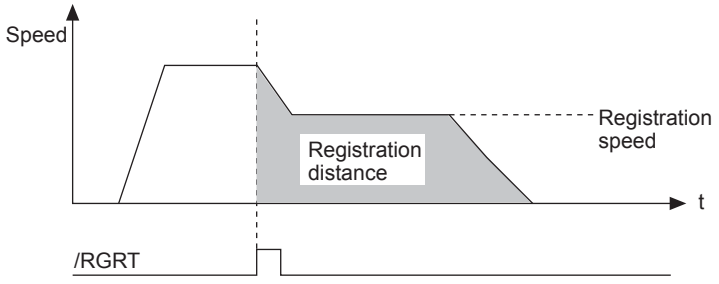
See *5.7 Registration* for details on the Registration function.

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	30000	100000	15000	NNNNN	IT0	1	1
1	I–200000	30000	100000	15000	: : : : :	IT0	1	0



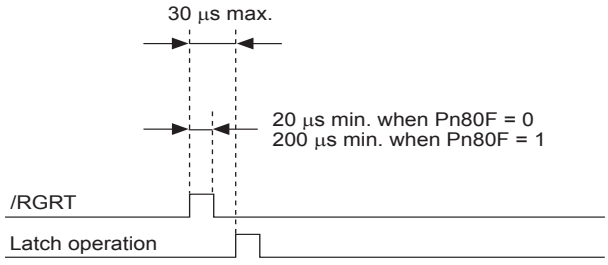
5.7 Registration

Positioning is performed for the specified distance and specified speed from the position where the /RGRT signal is latched.

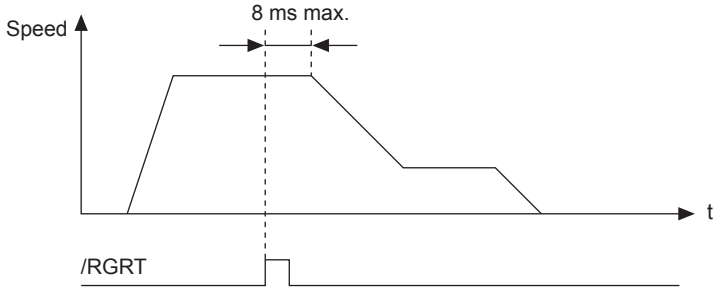


5.7.1 Registration Timing Specifications

The following figure shows the latch timing specifications.



- Shifting to Registration Operation



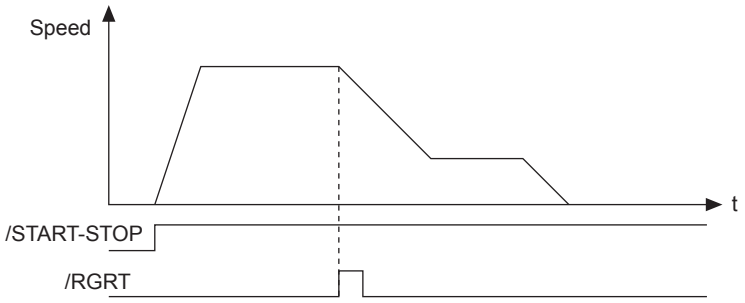
5.7.2 Registration Input Setting

Parameter Pn80F sets the logic for the /RGRT Registration Latch Signal.

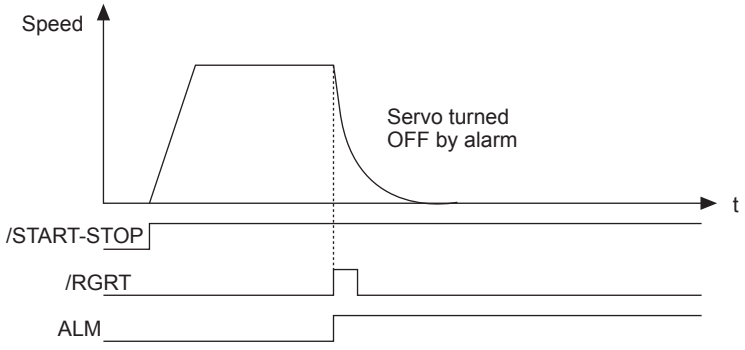
Parame-ter	Signal	Pin No.	Settings
Pn80F	/RGRT	CN1-46	0: Photocoupler ON = Latch 1: Photocoupler OFF = Latch

5.7.3 Registration Operation

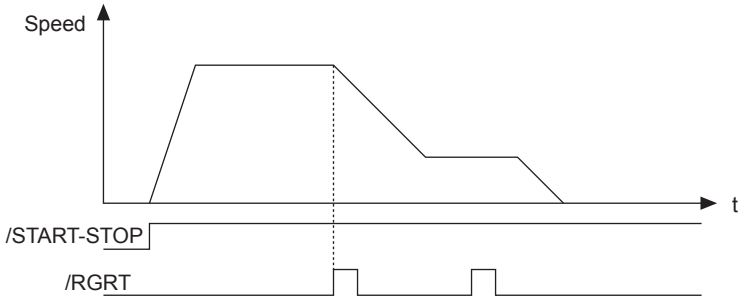
If the /RGRT signal becomes active (latches) during positioning, operation will proceed from the latch position to the registration distance only. The registration distance is specified in RDST.



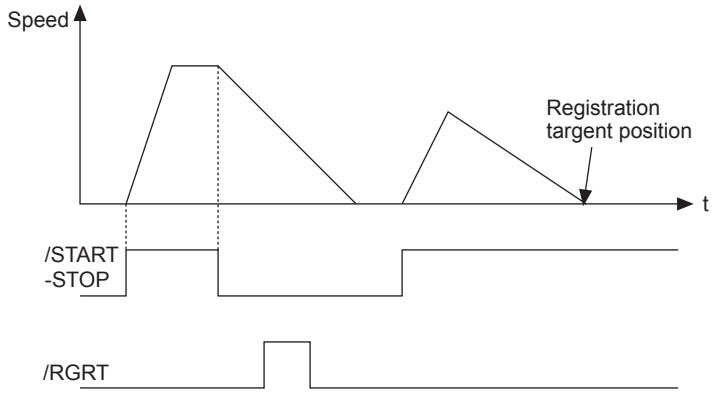
Alarm E23E will occur when the registration distance is too short, i.e., when positioning will move too far even if deceleration begins immediately. When alarm E23E occurs, the servo will go OFF and the program will stop.



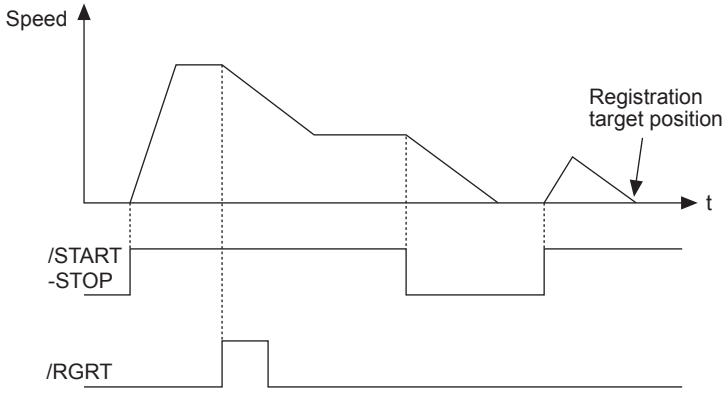
The second and later latch signals are ignored.



The /RGRT latch signal can be input while the program is stopped.



The program can be stopped during Registration operation. The Registration operation will be restarted if the program is restarted.



5.8 ZONE Table Settings

ZONE signals are signals that indicate regions defined in the ZONE table.
Outputs /POUT0 to /POUT4 must be specified as ZONE signals in order to use ZONE signals.

Table 5.3 ZONE Table

ZONE ID	ZONE N	ZONE P	Z4	Z3	Z2	Z1	Z0
0	±nnnnnnnn	±nnnnnnnn	---	---	---	---	---
1	±nnnnnnnn	±nnnnnnnn	---	---	---	---	Active
2	±nnnnnnnn	±nnnnnnnn	---	---	---	Active	---
3	±nnnnnnnn	±nnnnnnnn	---	---	---	Active	Active
4	±nnnnnnnn	±nnnnnnnn	---	---	Active	---	---
5	±nnnnnnnn	±nnnnnnnn	---	---	Active	---	Active
6	±nnnnnnnn	±nnnnnnnn	---	---	Active	Active	---
7	±nnnnnnnn	±nnnnnnnn	---	---	Active	Active	Active
8	±nnnnnnnn	±nnnnnnnn	---	Active	---	---	---
9	±nnnnnnnn	±nnnnnnnn	---	Active	---	---	Active
10	±nnnnnnnn	±nnnnnnnn	---	Active	---	Active	---
11	±nnnnnnnn	±nnnnnnnn	---	Active	---	Active	Active
12	±nnnnnnnn	±nnnnnnnn	---	Active	Active	---	---
13	±nnnnnnnn	±nnnnnnnn	---	Active	Active	---	Active
14	±nnnnnnnn	±nnnnnnnn	---	Active	Active	Active	---
15	±nnnnnnnn	±nnnnnnnn	---	Active	Active	Active	Active
16	±nnnnnnnn	±nnnnnnnn	Active	---	---	---	---
17	±nnnnnnnn	±nnnnnnnn	Active	---	---	---	Active
18	±nnnnnnnn	±nnnnnnnn	Active	---	---	Active	---
19	±nnnnnnnn	±nnnnnnnn	Active	---	---	Active	Active
20	±nnnnnnnn	±nnnnnnnn	Active	---	Active	---	---
21	±nnnnnnnn	±nnnnnnnn	Active	---	Active	---	Active
22	±nnnnnnnn	±nnnnnnnn	Active	---	Active	Active	---
23	±nnnnnnnn	±nnnnnnnn	Active	---	Active	Active	Active
24	±nnnnnnnn	±nnnnnnnn	Active	Active	---	---	---
25	±nnnnnnnn	±nnnnnnnn	Active	Active	---	---	Active
26	±nnnnnnnn	±nnnnnnnn	Active	Active	---	Active	---
27	±nnnnnnnn	±nnnnnnnn	Active	Active	---	Active	Active
28	±nnnnnnnn	±nnnnnnnn	Active	Active	Active	---	---
29	±nnnnnnnn	±nnnnnnnn	Active	Active	Active	---	Active
30	±nnnnnnnn	±nnnnnnnn	Active	Active	Active	Active	---
31	±nnnnnnnn	±nnnnnnnn	Active	Active	Active	Active	Active

Note: 1. The "---" symbols indicate inactive signal status.
2. ZONE ID: ZONE Number
ZONE N: Negative side ZONE boundary position
ZONE P: Positive side ZONE boundary position
Z0 to Z4: If the programmable output signals (/POUT0 to /POUT4) are specified as

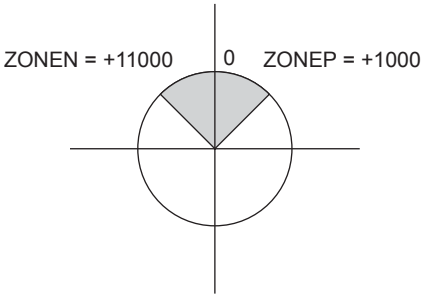
ZONE signals, /POUT0 = Z0, /POUT1 = Z1, /POUT2 = Z2, /POUT3 = Z3, and /POUT4 = Z4.

3. The status of outputs Z0 to Z4 is determined by the ZONE ID.
4. The programmable output signals (/POUT0 to /POUT4) must be specified as ZONE signals ("Z"). For example if POUT = ZAZZN, then signals Z1, Z2, and Z4 will be output from programmable outputs /POUT1, /POUT2, and /POUT4.

ZONE Signal Conditions

- When ZONEN ≤ ZONEP, the motor position is within range when ZONEN ≤ motor position ≤ ZONEP.
- When ZONEN > ZONEP, the motor position is within range when the motor position ≥ ZONEN or the motor position ≤ ZONEP.

◀ EXAMPLE ▶



- When the motor position is within range for two or more zones, only the lowest ZONE ID will be effective.
- If the motor position is not within range of any zones, signals Z0 to Z4 will all be inactive.
- A ZONE ID will be disabled if ZONEN = ZONEP = 0 is set for that zone.

5.9 Homing/Jog Speed Table Mode

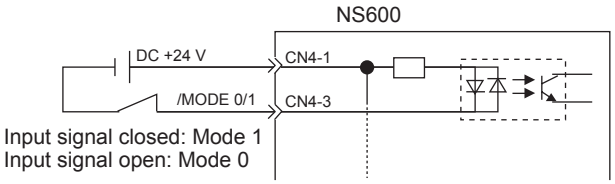
5.9.1 Mode Switch Signal (/MODE 0/1)

If the /MODE 0/1 input signal is inactive, the mode is set to Mode 1 (homing/jog speed table operation mode). Parameter Pn803 sets the relationship between the signal's ON/OFF status and its active/inactive status.

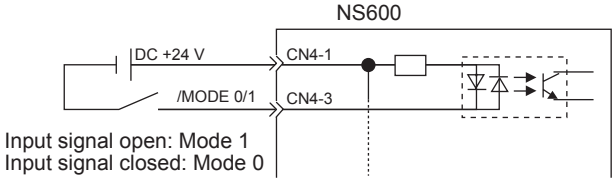
Parameter	Signal	Pin No.	Settings	Factory Setting
Pn803	/MODE 0/1	CN4-3	0: Photocoupler OFF = Mode 1 1: Photocoupler ON = Mode 1 2: Always Mode 0 3: Always Mode 1	0

◀ EXAMPLE ▶

- Pn803 = 1



- Pn803 = 0



5.9.2 Homing/Jog Speed Table Input Signals

The input signals are set with the parameters shown in the following table.

Param-eter	Signal	Pin No.	Settings	Factory Setting
Pn804	/HOME	CN4-5	0 = Photocoupler ON = Homing Start 1 = Photocoupler OFF = Homing Start 2 = Always active 3 = Always inactive	0
Pn80E	/DEC	CN1-44	0 = Photocoupler ON = Homing Deceleration Start 1 = Photocoupler OFF = Homing Deceleration Start 2 = Always homing Deceleration 3 = No homing Deceleration	0
Pn805	/JOGP	CN4-7	0 = Photocoupler ON = Jog Forward 1 = Photocoupler OFF = Jog Forward 2 = Always active 3 = Always inactive	0
Pn806	/JOGN	CN4-9	0 = Photocoupler ON = Jog Reverse 1 = Photocoupler OFF = Jog Reverse 2 = Always active 3 = Always inactive	0
Pn807	/JOG0	CN4-11	0 = Photocoupler ON = Active 1 = Photocoupler OFF = Active 2 = Always active 3 = Always inactive	0
Pn808	/JOG1	CN4-13		0
Pn809	/JOG2	CN4-15		0
Pn80A	/JOG3	CN4-17		0

5.9.3 Parameters Related to Homing

Set the homing parameters with the parameters listed in the following table.

Parame-ter	Name	Settings	Unit	Factory Setting
Pn823	Homing method	0 = No Homing 1 = /DEC and phase C 2 = /DEC only 3 = Phase C only	---	0
Pn824	Homing direction	0 = Forward 1 = Reverse	---	0
Pn825	Homing Moving Speed	0 to 99,999,999	×1,000 Reference units/min	1,000
Pn826	Homing Approach Speed	0 to 99,999,999	×1,000 Reference units/min	1,000
Pn827	Homing Creep Speed	0 to 99,999,999	×1,000 Reference units/min	1,000
Pn828	Homing Final Moving Distance	-99,999,999 to 99,999,999	Reference units	0

5.10 Homing Operation

Homing starts when the /HOME signal becomes active.

Homing stops if the /HOME signal becomes inactive again.

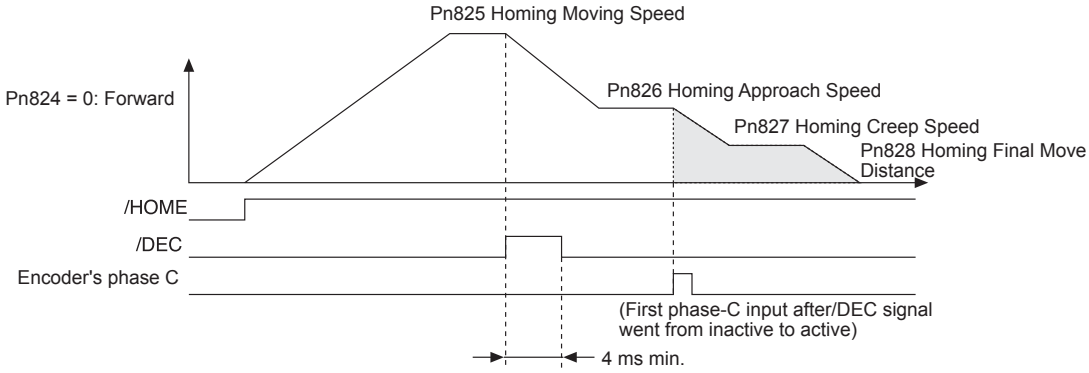
If the /HOME signal becomes active again while the homing operation is stopped, homing will be restarted from the point where it was interrupted.

The homing operation will be cancelled if operation is switched to Jog Speed Table Mode with the /JOGP signal or /JOGN signal or the mode is switched with the /MODE 0/1 signal while the homing operation is stopped.

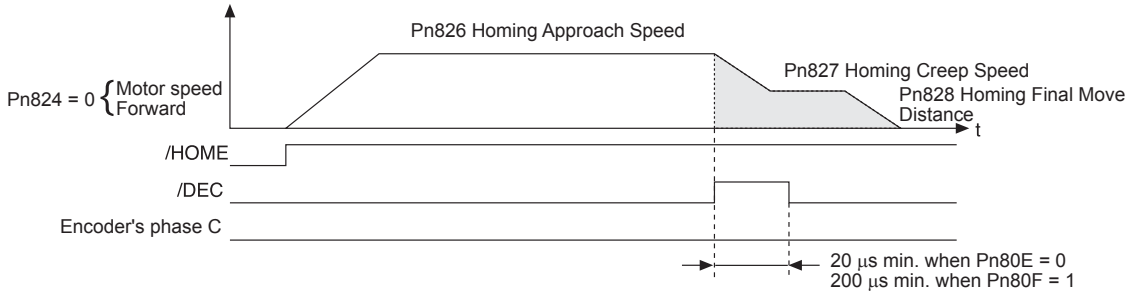
When parameter Pn823 = 0 (No Homing), homing will end as soon as the control power supply is turned ON or the RES command is executed.

The smaller of the settings in parameter Pn81F (Acceleration) and Pn820 (Deceleration) will be used as the homing acceleration and deceleration rate.

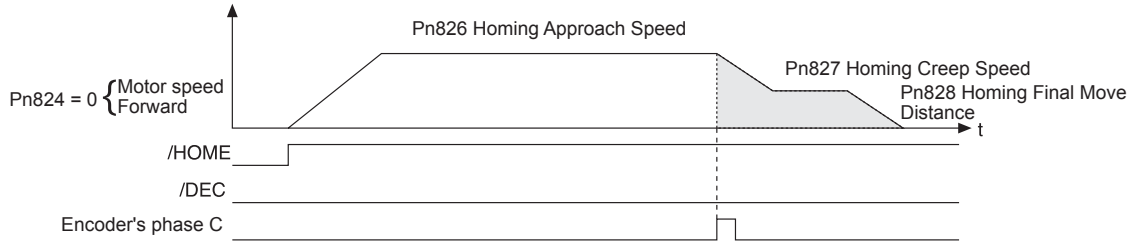
- Mode 1 (Pn823 = 1: /DEC and phase C)



- Mode 2 (Pn823 = 2: /DEC only)


Pn826 Homing Approach Speed
Pn824 = 0 { Motor speed Forward
Pn827 Homing Creep Speed
Pn828 Homing Final Move Distance
t
/HOME
/DEC
Encoder's phase C
20 μs min. when Pn80E = 0
200 μs min. when Pn80F = 1

- Mode 3 (Pn823 = 3: phase C only)



5.11 Jog Speed Table Operation

The /JOGP signal selects forward operation and the /JOGN signal selects reverse operation.

The /JOG0 to /JOG3 signals select the speed.

5.11.1 Example of Jog Speed Table Operation

The following diagram shows an example of Jog Speed Table operation.

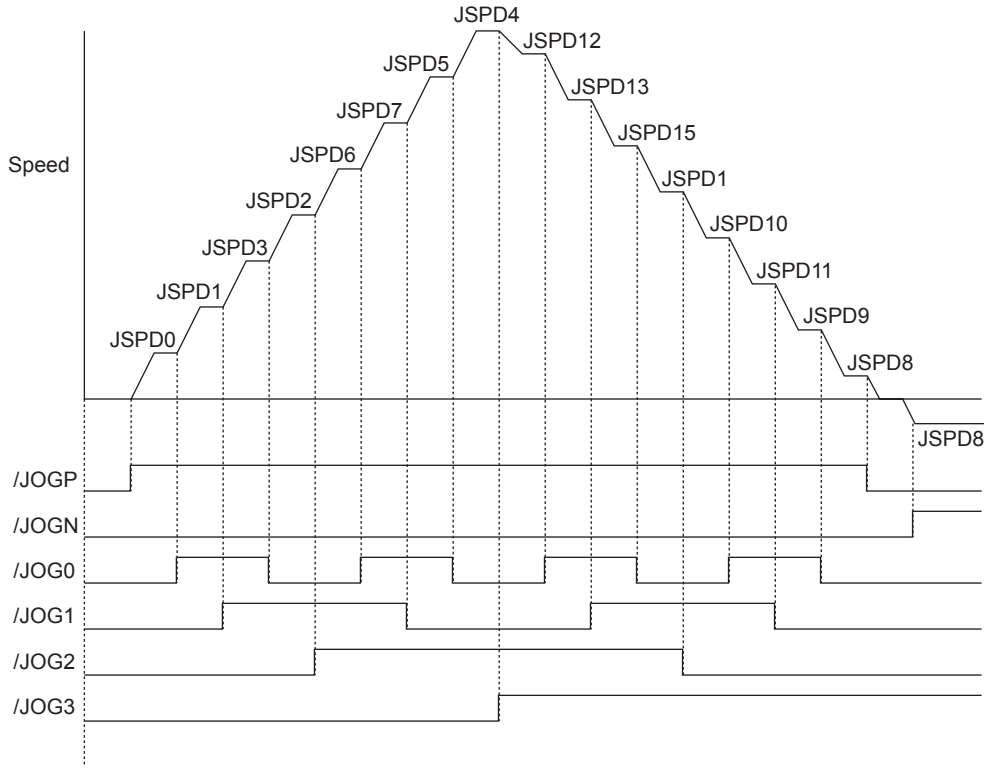


Fig. 5.1 Jog Speed Table Operation

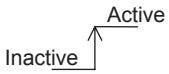
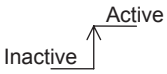
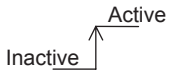
5.11.2 Jog Speed Table Selection

JSPD	Jog Speed (JSPD)	Selection Signals			
		/JOG3	/JOG2	/JOG1	/JOG0
0	nnnnnnnn	---	---	---	---
1	nnnnnnnn	---	---	---	Active
2	nnnnnnnn	---	---	Active	---
3	nnnnnnnn	---	---	Active	Active
4	nnnnnnnn	---	Active	---	---
5	nnnnnnnn	---	Active	---	Active
6	nnnnnnnn	---	Active	Active	---
7	nnnnnnnn	---	Active	Active	Active
8	nnnnnnnn	Active	---	---	---
9	nnnnnnnn	Active	---	---	Active
10	nnnnnnnn	Active	---	Active	---
11	nnnnnnnn	Active	---	Active	Active
12	nnnnnnnn	Active	Active	---	---
13	nnnnnnnn	Active	Active	---	Active
14	nnnnnnnn	Active	Active	Active	---
15	nnnnnnnn	Active	Active	Active	Active

Note: 1. The “---” symbols indicate inactive signal status.
2. JSPD: Jog speed number
/JOG0 to /JOG3: Selection signals
Jog speed: Speed setting
Setting range: 1 to 99,999,999 (×1,000 Reference units/min)
Factory setting: 1,000

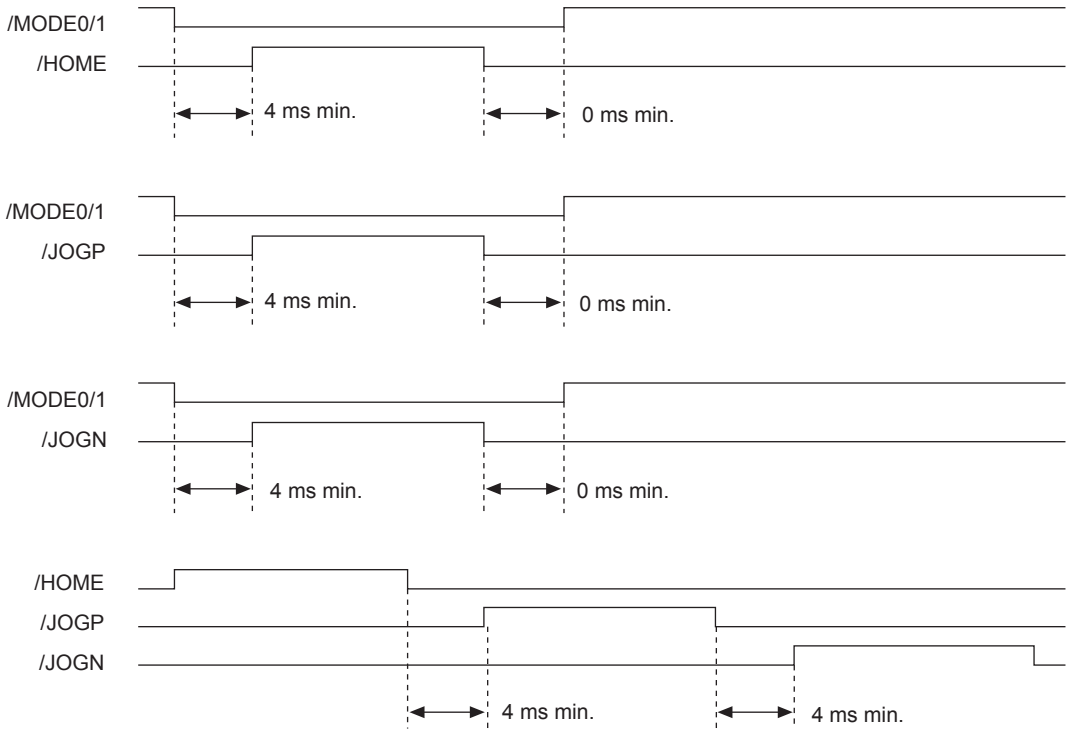
5.11.3 Input Conditions for Homing and Jog Speed Table Operation

The following table shows the functions of the signals related to homing and jog speed table operation.

/HOME	/JOGP	/JOGN	Operation
			Start or restart homing
			Jog forward
			Jog reverse
			Stop
			Stop
			Stop
			Stop
			Stop

5.11.4 Input Signal Timing Specifications for Homing and Jog Speed Table

The following figures show the timing specifications of input signals for homing and jog speed table operation.



6

Serial Command Communications

This chapter explains the NS600's serial command capabilities.

6.1 CN6 Connector Specifications ----------6-2

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6.7.7 Jog Speed Table Setup Commands ---------- 6-32

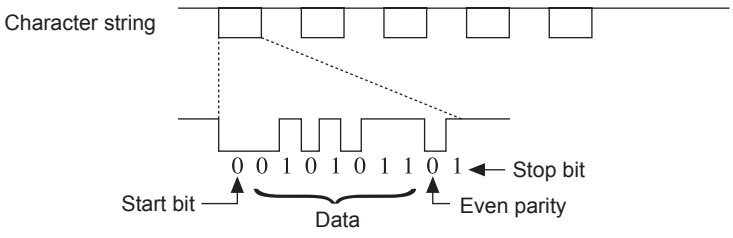
6.7.8 Monitor and Auxiliary Function Commands ---------- 6-33

6.1 CN6 Connector Specifications

The following table shows the specifications of the CN6 connector.

Item	Specifications
Interface	Full duplex (RS-422, RS-485, or RS-232C) or half duplex (RS-485) (Set the appropriate wiring method with parameter Pn800.)
Synchronization	Start-stop synchronization (ASYNC)
Baud Rate	9,600, 19,200, or 38,400 baud (Selectable with parameter Pn801.)
Start Bits	1 bit
Data Bits	7 bits, ASCII
Parity	1 bit, even parity
Stop Bits	1 bit
X-ON/X-OFF Control	No
DTR/DSR Control	No
RTS/CTS Control	No
Echoback	Each character, Each command, or None (Selectable with parameter Pn800.)

Data Configuration

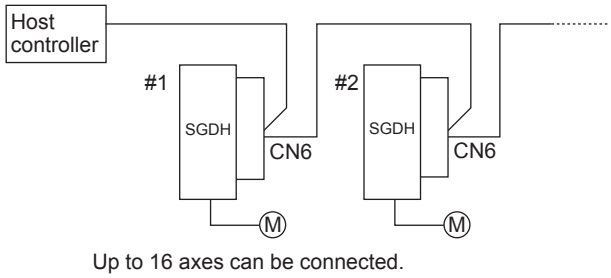


6.2 Settings

This section explains the settings for the NS600's serial commands.

6.2.1 Block Diagram

The following block diagram shows the basic connections for multi-axis control.



Up to 16 axes can be connected.

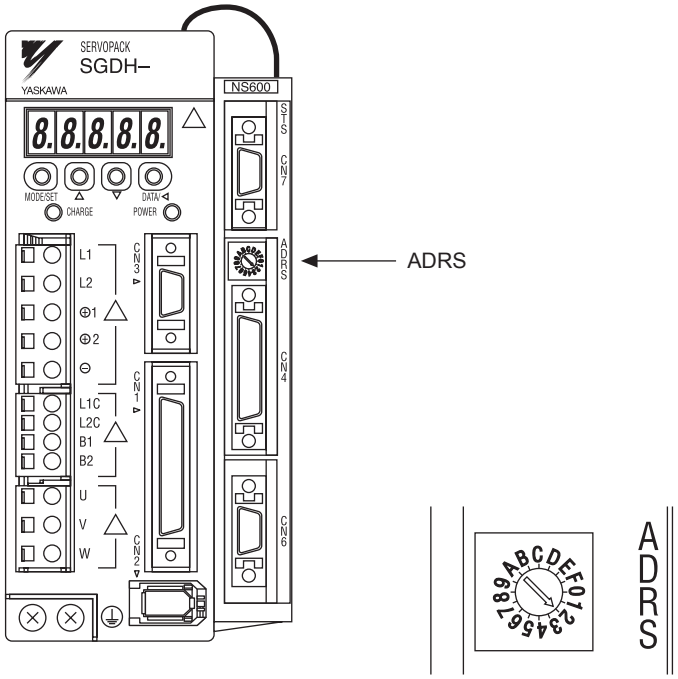
For details on wiring, see *3.2 Serial Command Communications Connector (CN6)*.

Initial Settings

- Axis address
- Protocol
- Baud rate

6.2.2 Setting the Axis Address

Set the axis number on the ADRS rotary switch. Up to 16 axes can be connected (0 to 9 and A to F).



6.2.3 Parameters Related to Serial Communications

The following table shows the parameters that set the communications protocol, baud rate, and “OK” response.

Parame-ter	Function	Settings	Factory Setting
Pn800	Protocol	0: Full-duplex wiring 1: Full-duplex wiring, Echoback each character 2: Half-duplex wiring, delimiter CR 3: Half-duplex wiring, delimiter CR, Echoback each character 4: Half-duplex wiring, delimiter CR, Echoback each command 5: Half-duplex wiring, delimiter CR LF 6: Half-duplex wiring, delimiter CR LF, Echoback each character 7: Half-duplex wiring, delimiter CR LF, Echoback each command	1
Pn801	Baud rate	0: 9,600 bps 1: 19,200 bps 2: 38,400 bps	0
Pn802	Response "OK”	0: Disables response “OK.” 1: Enables response “OK.”	1

6.3 Command/Response Format

The following diagram shows the command/response format.

<table>
<tr><th>Command (Host controller → NS600)</th><th>Response (Host controller ← NS600)</th></tr>
<tr><td>
<table>
<tr><td>Axis no.</td><td>Command character string</td><td>Delimiter</td></tr>
</table>
Example:
1SVON [CR]
2SVON [CR]
1POS10000 [CR]
2POS10000 [CR]
1ST [CR]
2ST [CR]
1PUN [CR]
2PUN [CR]

Note: When full-duplex wiring is being used, either [CR] or [CR] [LF] can be used as the delimiter.
When half-duplex wiring is being used, the delimiter can be set to either [CR] or [CR] [LF] with parameter Pn800.
In both cases, [CR] [LF] will be returned as the echo-back.
Upper-case and lower-case characters can be used in the command (including the axis number) and are treated the same.
</td><td>
<table>
<tr><td>Axis no.</td><td>Response character string</td><td>Delimiter</td></tr>
</table>
Example:
1OK [CR] [LF]
2OK [CR] [LF]
1OK [CR] [LF]
2OK [CR] [LF]
1OK [CR] [LF]
2OK [CR] [LF]
1PUN = +00004567 [CR] [LF]
2PUN = -00002345 [CR] [LF]

Note: The response's delimiter is always [CR] [LF].
Alphabetical characters in the response are always upper-case.
</td></tr>
</table>

Note: In ASCII, the [CR] character is 0D Hex and the [LF] character is 0A Hex.

IMPORTANT

To maximize communications reliability, confirm the echoback and responses to each command while communicating with the NS600. When the echoback and responses are not being confirmed, communications reliability can be improved by reading the status when appropriate.

6.4 Global Commands

Global commands are commands that are sent to all axes at the same time.

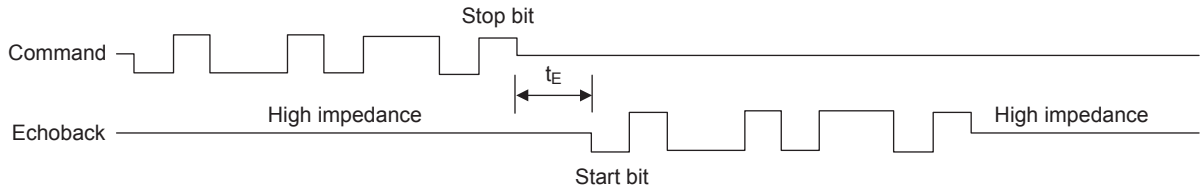
Command (Host controller → NS600)	Response (Host controller ← NS600)
“ * ” | Command character string | Delimiter Example: *SVON [CR] *ST [CR] *PUN [CR] The axis number setting “*” is the global address and addresses all axes. No echoback or response is returned when the global address is used.	No response returned.

IMPORTANT

When global commands are used, communications reliability can be improved by reading the status when appropriate.

6.5 Echoback Response Time

The following diagram shows the response time from the command transmission until the echoback.



Pn800 (Protocol) Settings	t_E Min.	t_E Max.
1: Full-duplex wiring, Echoback each character	$-\frac{1}{\text{Baud rate} \times 2}$ (Centered at the command stop bit)	$100\ \mu s + \frac{1}{\text{Baud rate} \times 2}$
3: Half-duplex wiring, delimiter CR, Echoback each character	$250\ \mu s - \frac{1}{\text{Baud rate} \times 2}$	$600\ \mu s + \frac{1}{\text{Baud rate} \times 2}$
4: Half-duplex wiring, delimiter CR, Echoback each command		
6: Half-duplex wiring, delimiter CR LF, Echoback each character		
7: Half-duplex wiring, delimiter CR LF, Echoback each command		

◀ EXAMPLE ▶

- Echoback response time when Pn800 = 1 (9,600 bps):

$$t_E \text{ min.} = -\frac{1}{\text{Baud rate} \times 2} = -\frac{1}{9{,}600 \times 2} = -52\ \mu s$$

IMPORTANT

When using half-duplex wiring, the host controller must set the line driver to high-impedance within the t_E min. response time.

6.6 Response Data Details

There are positive responses and negative responses. The positive response indicates normal operation and the negative response indicates an error.

6.6.1 Positive Responses

There two kinds of positive responses, responses that return data (for commands such as PRM) and responses that do not return data (for commands such as SVON).

For commands that require data to be returned, see the description of the individual command for details on the structure of the response's character string.

For commands that do not require data to be returned, the positive response is "OK" unless parameter Pn802 is set to 0. If Pn802 = 0, there is no response.

Structure of the Response "OK"

OK [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]

Note: The ASCII values for these special characters are 20 Hex for [SP], 0D Hex for [CR], and 0A Hex for [LF].

6.6.2 Negative Responses

There will be no response if one of the following errors is detected: a parity error (E48E), framing error (E49E), or overrun error (E4AE). Furthermore, there will be no response to a global command or a command with an incorrect axis number.

In all other cases, a negative response will be returned if an error is detected.

Structure of the Negative Response

Undefined Command Error	E56E [SP] ERR [SP] SN [CR] [LF]
Address Out-of-range Error	E57E [SP] ERR [SP] PN [CR] [LF]
Data Out-of-range Error	E58E [SP] ERR [SP] OV [CR] [LF]
Other Errors	ExxE [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] (The xx is the error number.)

Note: The ASCII values for these special characters are 20 Hex for [SP], 0D Hex for [CR], and 0A Hex for [LF].

6.7 Serial Commands

The axis number and delimiter are attached to actual serial commands, but are omitted here.

Some data in responses (such as parameters, table numbers, and monitored data) is expressed numerically. The sign and the number of digits are correct in the numerical data shown in these examples, but the sign and number of digits will vary in actual applications.

6.7.1 Basic Operation Commands

The following table shows the basic operation commands.

Table 6.1 Basic Operation Commands

Serial Command	Function	Positive Response (Normal Response)
SVON	Servo ON Supplies power to the motor. This command is the same as turning ON the /S-ON signal.	OK
SVOFF	Servo OFF Stops the power supply to the motor. This command is the same as turning OFF the /S-ON signal.	OK
ARES	Alarm Reset Clears the alarm.	The response “OK” will be returned when the alarm has been cleared. The alarm code will be returned if the alarm remains uncleared. ALM [SP] A. xx [SP] [CR] [LF] (The xx is the SGDH alarm code.) ALM [SP] E xxA [SP] [CR] [LF] (The xx is the NS600 alarm code.)
RES	Reset This command is the same as turning the control power supply OFF and then ON again.	OK

6.7.2 Control Commands

The following table shows the control commands.

Table 6.2 Control Commands

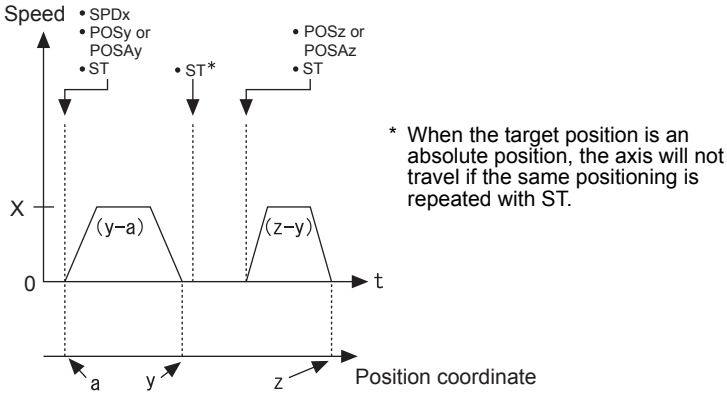
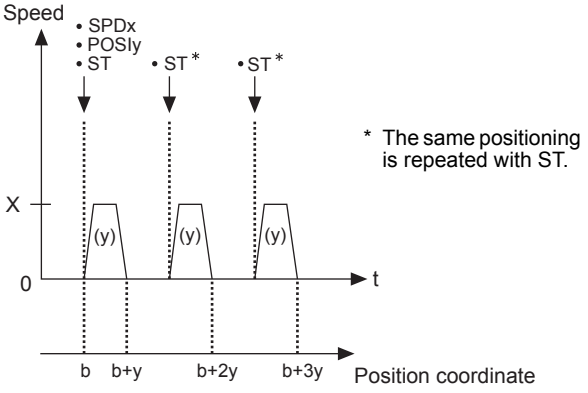
Serial Command	Function	Positive Response
POS (±) nnnnnnnn POSA (±) nnnnnnnn (The + sign can be omitted.)	Target Position Reservation (Absolute Position) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the target position as an absolute position.  Note: If a new target position is specified during positioning, the new target position will be used in the next ST command.	OK
POSI (±) nnnnnnnn (The + sign can be omitted.)	Target Position Reservation (Relative Position) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the target position as a relative distance.  Note: If a new target position is specified during positioning, the new target position will be used in the next ST command.	OK

Table 6.2 Control Commands (cont'd)

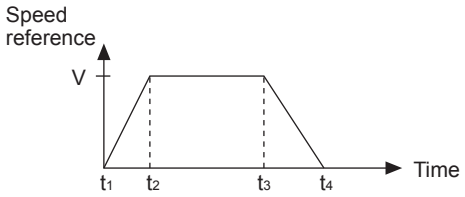
Serial Command	Function	Positive Response
SPDnnnnnnnn	Positioning Speed Reservation Setting range: 1 ≤ nnnnnnnn ≤ +99,999,999 [×1,000 reference units/min] Specifies the positioning speed. After the control power supply is turned ON (or the RES command is executed), the positioning speed set in parameter Pn81E will be used until the SPD command is executed. For example, when the reference unit is 0.01 mm and the desired speed is 15 m/min: 1500 mm/min / 0.01 mm = 1,500,000 references units/min = 1500 [×1,000 reference units/min] SPD1500 Note: If a new positioning speed is specified during positioning, the new speed will not become effective until the next positioning operation.	OK
ACCnnnnnnnn	Acceleration Reservation Setting range: 1 ≤ nnnnnnnn ≤ +99,999,999 [×1,000 reference units/min/ms]  $\text{Acceleration} = \frac{V\ [\times 1{,}000 \text{ reference units/min}]}{t_2 - t_1\ [\text{ms}]}$ $\text{Deceleration} = \frac{V\ [\times 1{,}000 \text{ reference units/min}]}{t_4 - t_3\ [\text{ms}]}$ Note: The acceleration setting in parameter Pn81F can also be used. Executing the command ACCnnnnnnnn is the same as executing TRM81F = nnnnnnnn.	OK
DECnnnnnnnn	Deceleration Reservation Setting range: 1 ≤ nnnnnnnn ≤ +99,999,999 [×1,000 reference units/min/ms] Note: The deceleration setting in parameter Pn820 can also be used. Executing the command DECnnnnnnnn is the same as executing TRM820 = nnnnnnnn.	OK

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Table 6.2 Control Commands (cont'd)

Serial Command	Function	Positive Response
ST	Positioning Start Starts positioning with the speed specified by the SPD command and the target position specified by the POS, POSA, or POSI command. The target position reservation and speed reservation can be omitted. In this case, the previous positioning will be repeated. Error E51E will occur if the ST command is executed but the target position hasn't been specified even once. If the ST command is executed but the speed hasn't been specified even once, the speed specified in parameter Pn81E will be used. When positioning has been stopped with the HOLD command, the positioning will be restarted (the hold will be cleared) if the ST command is executed. Example 1: POSI + nnnnnnnn: Target Position Reservation SPDnnnnnnnn: Speed Reservation ST: Positioning Start ST: Repeat Example 2: POSI + nnnnnnnn: Target Position Reservation ST: Positioning Start (using the speed specified in Pn81E) Example 3: POSI + nnnnnnnn: Target Position Reservation ST: Positioning Start HOLD: Positioning Interruption ST: Positioning Restart (Clear Hold) Note: An E53E error will occur if a new travelling command (such as the ST command) is received while the motor is already travelling (positioning or other travelling operation). Execute a travelling command such as the ST command only after the previous travelling operation has been completed.	OK

Table 6.2 Control Commands (cont'd)

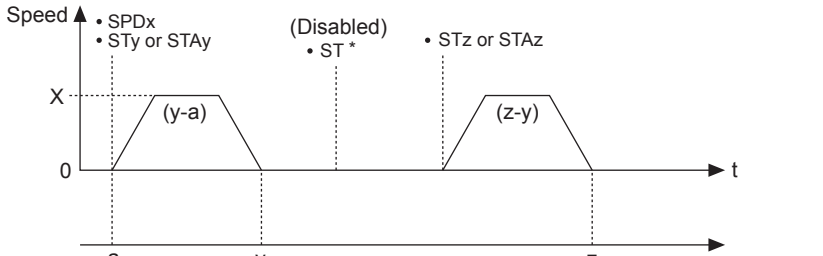
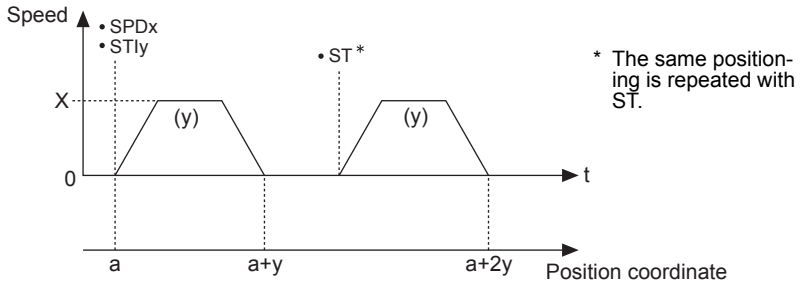
Serial Command	Function	Positive Response
ST (±) nnnnnnnn STA (±) nnnnnnnn (The + sign can be omitted.)	Positioning Start (Absolute Position) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the absolute position nnnnnnnn as the target position and starts positioning at the same time. This command is equivalent to the following combination: POSA + nnnnnnnn → ST. Example: SPDnnnnnnnn: Speed Reservation STA + nnnnnnnn: Target Position Reservation and Positioning Start  * When the target position is an absolute position, the axis will not travel if the same positioning is repeated with ST.	OK
STI (±) nnnnnnnn (The + sign can be omitted.)	Positioning Start (Relative Position) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the relative distance nnnnnnnn as the target position and starts positioning at the same time. This command is equivalent to the following combination: POSI + nnnnnnnn → ST. Example: SPDnnnnnnnn: Speed Reservation STI + nnnnnnnn: Target Position Reservation and Positioning Start  	OK

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Table 6.2 Control Commands (cont'd)

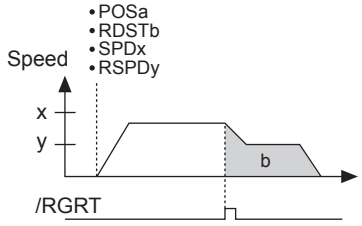
Serial Command	Function	Positive Response
RDSTnnnnnnnn	Registration Distance Reservation Setting range: 0 ≤ nnnnnnnn ≤ 99,999,999 [Reference units] Specifies the registration distance that is used in the RS, RSnnnnnnnn, RSAnnnnnnnn, and RSInnnnnnnn commands.  Note: Alarm E23A will occur (the motor Servo will go OFF) if the /RGRT signal latched but the registration distance is longer than the deceleration distance, i.e., the registration distance will be exceeded even if deceleration begins immediately.	OK
RSPDnnnnnnnn	Registration Speed Reservation Setting range: 1 ≤ nnnnnnnn ≤ 99,999,999 [×1,000 reference units/min] Specifies the registration speed. After the control power supply is turned ON (or the RES command is executed), the positioning speed set in parameter Pn81E will be used until the speed is specified with this command. Note: If a new registration speed is specified during registration operation, the new speed will not become effective until the next registration operation.	OK

Table 6.2 Control Commands (cont'd)

Serial Command	Function	Positive Response
RS	Positioning Start with Registration Starts positioning with the speed specified by the SPD command and the target position specified by the POS, POSA, or POSI command. If the /RGRT signal goes ON during positioning, that position is latched and the motor will move the specified relative distance from the latched position. The registration operation uses the registration distance specified by the RDST command and the registration speed specified by the RSPD command. The target position reservation, positioning speed reservation, registration distance reservation, and registration speed reservation can be omitted. In this case, the positioning performed in the previous registration operation will be repeated. Error E51E will occur if the RS command is executed but the target position hasn't been specified even once. Error E52E will occur if the RS command is executed but the registration distance hasn't been specified even once. If the RS command is executed but the positioning speed and registration speed haven't been specified even once, the speed specified in parameter Pn81E will be used for both the positioning speed and registration speed. When registration positioning has been stopped with the HOLD command, the registration positioning will be restarted (the hold will be cleared) if the RS command is executed. Example 1: POSI + nnnnnnnn: Target Position Reservation SPDnnnnnnnn: Speed Reservation RDSTnnnnnnnn: Registration Distance Reservation RSPDnnnnnnnn: Registration Speed Reservation RS: Positioning Start with Registration RS: Repeat Example 2: POSI + nnnnnnnn: Target Position Reservation RDSTnnnnnnnn: Registration Distance Reservation RS: Positioning Start with Registration (using the speed specified in Pn81E for both the positioning and registration speeds) Example 3: POSI + nnnnnnnn: Target Position Reservation RDSTnnnnnnnn: Registration Distance Reservation RS: Positioning Start with Registration HOLD: Positioning Interruption RS: Positioning Restart (Clear Hold) Note: Error E53E will occur if a new travelling command (such as the RS command) is received while the motor is already travelling (positioning or other travelling operation). Execute a travelling command such as the RS command only after the previous travelling operation has been completed.	OK

Table 6.2 Control Commands (cont'd)

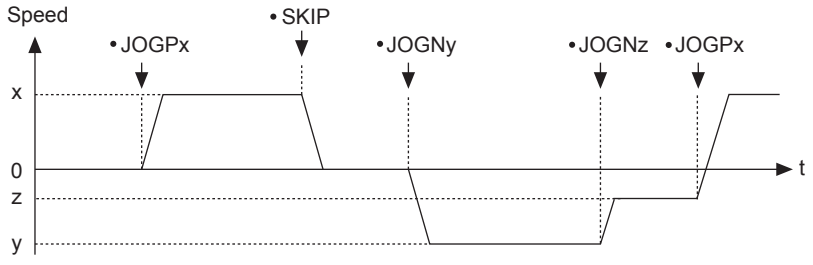
Serial Command	Function	Positive Response
RS (±) nnnnnnnn RSA (±) nnnnnnnn (The + sign can be omitted.)	Positioning Start with Registration (Absolute Position) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the absolute position nnnnnnnn as the target position and starts registration positioning at the same time. This command is equivalent to the following combination: POSA + nnnnnnnn → RS. Example: SPDnnnnnnnn: Speed Reservation RDSTnnnnnnnn: Registration Distance Reservation RSPDnnnnnnnn: Registration Speed Reservation RSA +nnnnnnnn: Target Position Reservation and Positioning Start with Registration	OK
RSI (±) nnnnnnnn (The + sign can be omitted.)	Positioning Start with Registration (Relative Distance) Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] Specifies the relative distance nnnnnnnn as the target position and starts registration positioning at the same time. This command is equivalent to the following combination: POSI + nnnnnnnn → RS. Example: SPDnnnnnnnn: Speed Reservation RDSTnnnnnnnn: Registration Distance Reservation RSPDnnnnnnnn: Registration Speed Reservation RSI +nnnnnnnn: Relative Position Reservation and Positioning Start with Registration	OK
JOGPnnnnnnnn JOGNnnnnnnnn	Jog Forward/Reverse Setting range: 1 ≤ nnnnnnnn ≤ 99,999,999 [×1,000 reference units/min] Starts jog forward or jog reverse operation at the speed specified in nnnnnnnn. JOGPnnnnnnnn: Forward JOGNnnnnnnnn: Reverse The specified speed and jog direction can be changed while jogging is in progress.  	OK

Table 6.2 Control Commands (cont'd)

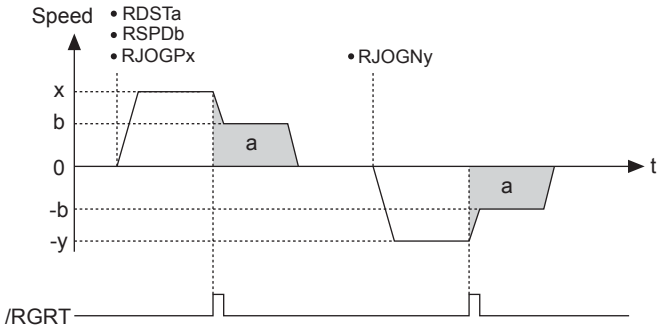
Serial Command	Function	Positive Response
RJOGPnnnnnnnn RJOGNnnnnnnnn	Jog Forward/Reverse with Registration Setting range: 1 ≤ nnnnnnnn ≤ 99,999,999 [×1,000 reference units/min] Starts jog forward or jog reverse operation at the speed specified in nnnnnnnn. RJOGPnnnnnnnn: Forward RJOGNnnnnnnnn: Reverse If the /RGRT signal goes ON during forward/reverse jogging, that position is latched and the motor will move the specified relative distance from the latched position. The registration operation uses the registration distance specified by the RDST command and the registration speed specified by the RSPD command. Error E52E will occur if the RJOGP/RJOGNnnnnnnnn command is executed but the registration distance hasn't been specified even once. If the RJOGP/RJOGNnnnnnnnn command is executed but the registration speed hasn't been specified even once, the speed specified in parameter Pn81E will be used for the registration speed. When registration jogging has been stopped with the HOLD command, forward registration jogging will be restarted (the hold will be cleared) when the RJOGPnnnnnnnn command is executed again. (Reverse registration jogging will be restarted when the RJOGNnnnnnnnn command is executed again.) The specified speed and direction cannot be changed while jogging is in progress. Error E53E will occur if the speed or direction is changed during operation.  	OK

Table 6.2 Control Commands (cont'd)

<table>
<tr><th>Serial Command</th><th>Function</th><th>Positive Response</th></tr>
<tr><td>ZRN</td><td>Homing Start

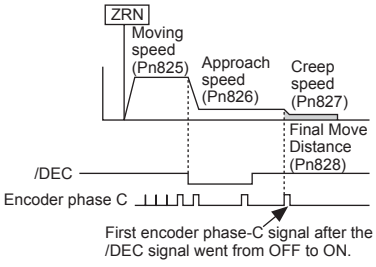
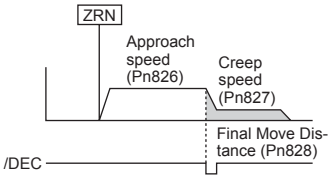
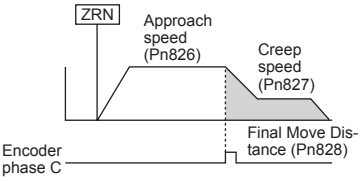
Starts homing operation.
When homing has been stopped with the HOLD command, homing will be restarted (the hold will be cleared) when the ZRN command is executed again.
The parameters for homing are specified in parameters Pn823 to Pn828.
<table>
<tr><th>Pn823
Homing Method</th><th>Pn824
Homing Direction</th><th>Pn825 to Pn828</th></tr>
<tr><td>Pn823 = 0:
No homing.
Homing ends when the control power supply is turned ON or the RES command is executed.</td><td>---</td><td>---</td></tr>
<tr><td>Pn823 = 1:
Use the /DEC signal and the encoder's phase C.</td><td rowspan="3">Pn824 = 0: Forward
Pn824 = 1: Reverse</td><td> 
</td></tr>
<tr><td>Pn823 = 2:
Use the /DEC signal only.</td><td> 
</td></tr>
<tr><td>Pn823 = 3:
Use the encoder's phase C only.</td><td> 
</td></tr>
</table>
The home position when homing is completed is specified in Pn81D.
When the control power supply is turned ON (or the RES command is executed) and homing is completed, the home position is replaced with the value in Pn81D.</td><td>OK</td></tr>
</table>

Table 6.2 Control Commands (cont'd)

<table>
<tr><th>Serial Command</th><th>Function</th><th>Positive Response</th></tr>
<tr><td>ZRN</td><td>
<table>
<tr><th>Parameter</th><th>Name</th><th>Settings</th></tr>
<tr><td>Pn81D</td><td>Home Position</td><td>–99,999,999 to +99,999,999
[Reference units]</td></tr>
<tr><td>Pn823</td><td>Homing Method</td><td>0: No Homing
1: /DEC and Encoder phase C
2: /DEC signal only
3: Encoder phase C only</td></tr>
<tr><td>Pn824</td><td>Homing Direction</td><td>0: Forward
1: Reverse</td></tr>
<tr><td>Pn825</td><td>Homing Moving Speed</td><td>1 to 99,999,999
[×1,000 reference units/min]</td></tr>
<tr><td>Pn826</td><td>Homing Approach Speed</td><td>1 to 99,999,999
[×1,000 reference units/min]</td></tr>
<tr><td>Pn827</td><td>Homing Creep Speed</td><td>1 to 99,999,999
[×1,000 reference units/min]</td></tr>
<tr><td>Pn828</td><td>Homing Final Move Distance</td><td>–99,999,999 to +99,999,999
[Reference units]</td></tr>
</table>
Note: 1. The software position reference limits (Pn81B and Pn81C) are disabled until homing is completed. They are effective after homing is completed. On the other hand, the overtravel signals (P-OT and N-OT signals) are effective before homing is completed.
2. When an incremental encoder is being used, homing will be completed if the ZSET command (Coordinates Setting) is executed instead of homing.
3. Error E5DE will occur if the ZRN command is executed while Pn823 = 0.
4. Homing can be performed only when an incremental encoder is being used. Error E61E will occur if the ZRN command is executed and an absolute encoder is being used.
</td><td>OK</td></tr>
</table>

Table 6.2 Control Commands (cont'd)

Serial Command	Function	Positive Response
ZSET (±) nnnnnnnn	Coordinates Setting Setting range: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999 [Reference units] • With an Incremental Encoder Replaces the home position with nnnnnnnn. Homing will be completed and the software position reference limits (Pn81B and Pn81C) will be enabled. This Coordinates Setting will be cleared when the control power supply is turned OFF or the RES command is executed. Note: Parameter Pn81D will not be refreshed. Pn81D will be used as the homing position when the control power supply is turned ON (or the RES command is executed) and homing is completed. • With an Absolute Encoder Refreshes Pn81D with the absolute position offset so that the home position becomes nnnnnnnn. The Coordinates Setting will remain effective after the control power supply is turned OFF or the RES command is executed. Normally, this command is executed once during system setup and it is not necessary to execute it again. Each time that the command is executed, the content of Pn81D are refreshed and stored in EEPROM, so this command must not be executed repeatedly or too frequently. Note: When the electronic gear ratio (Pn202/Pn203) has been changed, enable the new gear ratio by turning the control power supply OFF and then ON again (or executing the RES command) before executing the ZSET +/–nnnnnnnn command.	OK

Table 6.2 Control Commands (cont'd)

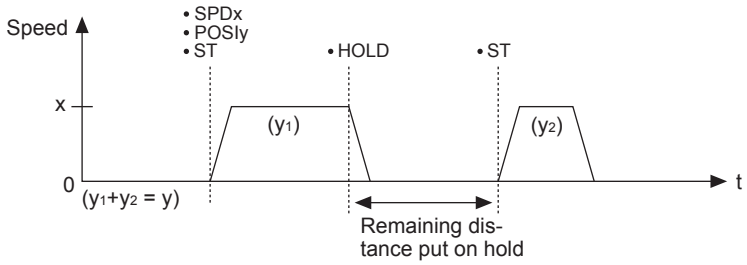
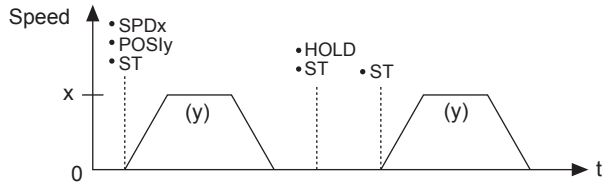
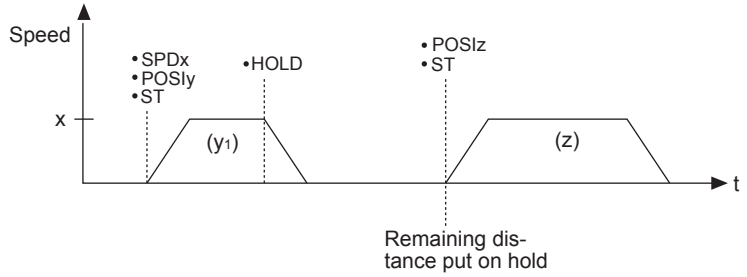
Serial Command	Function	Positive Response
HOLD	Positioning Interruption Interrupts the current positioning operation. The remainder of the positioning operation is put on hold. When the HOLD command has interrupted a positioning operation initiated by an ST, STnnnnnnnn, STAnnnnnnnn, or STInnnnnnnn command, the positioning operation can be restarted by executing the ST command. When the HOLD command has interrupted registration positioning initiated by an RS, RSnnnnnnnn, RSAnnnnnnnn, or RSInnnnnnnn command, the registration positioning operation can be restarted by executing the RS command. When the HOLD command has interrupted a "forward jogging with registration" operation that was initiated by the RJOGPnnnnnnnn command, the operation can be restarted by executing the RJOGPnnnnnnnn command again. When the HOLD command has interrupted a "reverse jogging with registration" operation that was initiated by the RJOGNnnnnnnnn command, the operation can be restarted by executing the RJOGNnnnnnnnn command again. When the HOLD command has interrupted a homing operation initiated by the ZRN command, homing can be restarted by executing the ZRN command. When the HOLD command is executed during a jog forward operation initiated by JOGPnnnnnnnn or a jog reverse operation initiated by JOGNnnnnnnnn, the jog operation will be stopped.  When the HOLD command is executed after positioning is completed, a remaining distance of zero is put on hold.  If a new target position is specified while a positioning operation has been put on hold by the HOLD command, the remaining distance (recorded by the HOLD command) is cancelled and the new target position is used instead.  	OK

Table 6.2 Control Commands (cont'd)

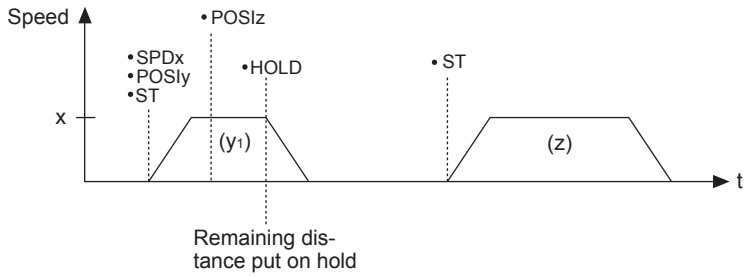
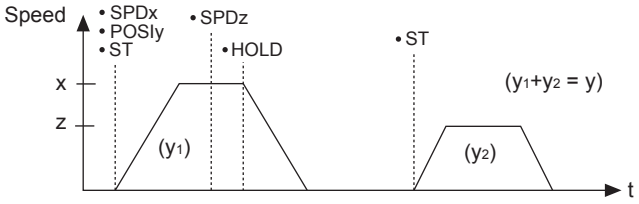
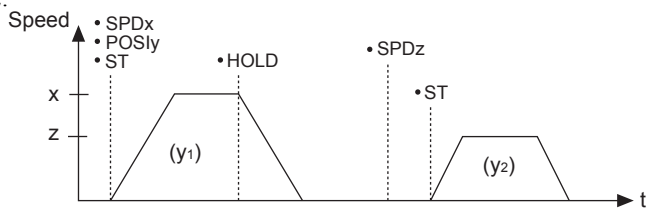
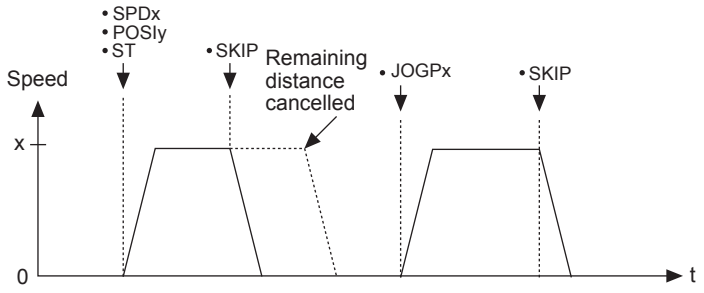
Serial Command	Function	Positive Response
HOLD	Even if a new target position is specified before the HOLD command is executed, the remaining distance will be cancelled and the new target position will be used instead.  When the speed setting has been changed, the new setting will be used when positioning is restarted. Example 1:  Example 2: 	OK
SKIP	Positioning Stop Stops the current positioning operation. The remainder of the positioning operation is cancelled. 	OK

Table 6.2 Control Commands (cont'd)

Serial Command	Function	Positive Response
POUTnnnnn	POUT Reservation Specifies the operation of programmable output signals POUT0 to POUT4. Settings: N: Inactive A: Active Z: Zone table : : Continue POUT n n n n n └ /POUT0 └ /POUT1 └ /POUT2 └ /POUT3 └ /POUT4	OK

6.7.3 Parameter Edit Commands

The following table shows the Parameter Edit Commands.

Table 6.3 Parameter Edit Commands

Serial Command	Function	Positive Response
PRMppp	Parameter Read Reads a parameter. ppp: Parameter number (Pn number) Example: Reading Pn800 Command: 1PRM800 [CR] Response: 1PRM800 = 00000001 [CR] [LF]	An 8-digit signed decimal value is returned for commands PRM81B, PRM81C, PRM81D, and PRM828. Example: PRM81B = +12345678 [CR] [LF] An 8-digit hexadecimal value is returned for commands PRM000 to PRM005, PRM080, PRM10B, PRM110, PRM200, PRM207, PRM408, and PRM50A to PRM512. Example: PRM000 = 00001234 [CR] [LF] An 8-digit unsigned decimal value is returned for all other parameters. Example: PRM800 = 12345678 [CR] [LF]
PRMppp = (±) nnnnnnnn	Parameter Write Sets a parameter. ppp: Parameter number (Pn number) Parameters are stored in EEPROM, so the settings will be retained after the control power supply is turned OFF or the RES command is executed. Since the value is stored in EEPROM, this command must not be used if the setting needs to be changed frequently. In this case, use the TRMppp = (±) nnnnnnnn command. Online parameters: The setting is enabled immediately. Offline parameters: Enable the setting by turning the control power supply OFF and ON or executing the RES command. Refer to *Appendix A List of Parameters* to determine whether a parameter is an online or offline parameter.	OK

Table 6.3 Parameter Edit Commands (cont'd)

Serial Command	Function	Positive Response
TRMppp = (±) nnnnnnnn	Temporary Parameter Write Sets a parameter. ppp: Parameter number (Pn number) The PRMppp = (±) nnnnnnnn command stores the parameter setting in EEPROM, but the TRMppp = (±) nnnnnnnn command does not. Since this command does not write the setting in EEPROM, it can be used to change settings frequently. Online parameters: The setting is enabled immediately. Offline parameters: Offline parameters must be enabled by turning the control power supply OFF and ON or executing the RES command, so the TRMppp = (±) nnnnnnnn command cannot be used to change these parameters. Use the PRMppp = (±) nnnnnnnn command. Refer to *Appendix A List of Parameters* to determine whether a parameter is an online or offline parameter.	OK
PRMINIT	Parameter Initialization Resets all parameters to their factory default settings. After executing PRMINIT, turn the control power supply OFF and ON or execute the RES command.	OK

6.7.4 Program Table Setup Commands

The following table shows the Program Table Setup Commands.

Table 6.4 Program Table Setup Commands

Serial Command	Function	Positive Response
PGMSTORE	Program Table Save Saves the program table in flash memory. Once PGMSTORE is executed, the program table will be retained after the control power supply is turned OFF or the RES command is executed. Since the program table is stored in flash memory, this command must not be executed frequently. Note: Do not turn OFF the control power supply while PGMSTORE is being executed. Execution can take slightly longer than 10 seconds. The green LED will flash during execution.	OK
PGMINIT	Program Initialization Resets all values in the program table to their factory default settings. Note: Do not turn OFF the control power supply while PGMINIT is being executed. Execution can take slightly longer than 10 seconds. The green LED will flash during execution.	OK
POSTsss	Program Table POS Read Reads the POS value (positioning target position). sss: Program step (PGMSTEP)	POST123 = A+12345678 [CR] [LF] POST123 = I+12345678 [CR] [LF] POST123 = +INFINITE [SP] [CR] [LF] POST123 = STOP [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF] POST123 = -[SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]
POSTsss = nnnnnnnn	Program Table POS Write Sets the POS value (positioning target position). sss: Program step (PGMSTEP) Settings: Annnnnnnn: Absolute position [Reference units] (–99,999,999 ≤ nnnnnnnn ≤ +99,999,999) Innnnnnnn: Relative distance [Reference units] (–99,999,999 ≤ nnnnnnnn ≤ +99,999,999) +INFINITE or -INFINITE: Jog forward or Jog reverse STOP: Stop -: No specification	OK
SPDTsss	Program Table SPD Read Reads the SPD value (positioning speed). sss: Program step (PGMSTEP)	SPDT123 = 12345678 [CR] [LF]

Table 6.4 Program Table Setup Commands (cont'd)

Serial Command	Function	Positive Response
SPDTsss = nnnnnnnn	Program Table SPD Write Sets the SPD value (positioning speed). sss: Program step (PGMSTEP) Settings: 1 ≤ nnnnnnnn ≤ +99,999,999 [×1,000 reference units/min]	OK
RDSTTsss	Program Table RDST Read Reads the RDST value (registration distance). sss: Program step (PGMSTEP)	RDSTT123 = 12345678 [CR] [LF] RDSTT123 = -[SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]
RDSTTsss = nnnnnnnn	Program Table RDST Write Sets the RDST value (registration distance). sss: Program step (PGMSTEP) Settings: 0 ≤ nnnnnnnn ≤ 99,999,999: Registration distance [Reference units] -: No registration	OK
RSPDTsss	Program Table RSPD Read Reads the RSPD value (registration speed). sss: Program step (PGMSTEP)	RSPDT123 = 12345678 [CR] [LF]
RSPDTsss = nnnnnnnn	Program Table RSPD Write Sets the RSPD value (registration speed). sss: Program step (PGMSTEP) Settings: 1 ≤ nnnnnnnn ≤ +99,999,999 [×1,000 reference units/min]	OK
POUTTsss	Program Table POUT Read Reads the POUT settings (programmable output signal specifications). sss: Program step (PGMSTEP)	POUTT123 = ANANZ [CR] [LF]

Table 6.4 Program Table Setup Commands (cont'd)

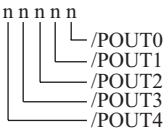
Serial Command	Function	Positive Response
POUTTsss = nnnnn	Program Table POUT Write Sets the POUT settings (programmable output signal specifications). sss: Program step (PGMSTEP) Settings: N: Inactive A: Active Z: Zone table : : Continue the POUT specifications used in the program step that was executed last.  	OK
EVENTTsss	Program Table EVENT Read Reads the EVENT value (end judgement). sss: Program step (PGMSTEP)	EVENTT123 = T12345 [SP] [SP] [SP] [SP] [CR] [LF] EVENTT123 = IT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = NT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = DT12345 [SP] [SP] [SP] [CR] [LF] EVENTT123 = SEL1T12345 [CR] [LF] EVENTT123 =:[SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]
EVENTTsss = nnnnnnnn	Program Table EVENT Write Sets the EVENT value (end judgement). sss: Program step (PGMSTEP) Settings: I: INPOSITION (positioning completed) active N: NEAR (positioning near) active D: DEN (positioning reference distribution) active SELx: SEL input signal active (x = 0 to 4) Tnnnnn: Time elapsed (ms) since the program step started. (0 ≤ nnnnn ≤ 99,999) ITnnnnn: Time elapsed (ms) after the INPOSITION signal became active. (0 ≤ nnnnn ≤ 99,999) NTnnnnn: Time elapsed (ms) after the NEAR signal became active. (0 ≤ nnnnn ≤ 99,999) DTnnnnn: Time elapsed (ms) after the DEN signal became active. (0 ≤ nnnnn ≤ 99,999) SELxnnnnn: Time elapsed (ms) after the SEL input signal became active. (x = 0 to 6, 0 ≤ nnnnn ≤ 99,999) : : Continue the specification used in the program step that was executed last.	OK

Table 6.4 Program Table Setup Commands (cont'd)

Serial Command	Function	Positive Response
LOOPTsss	Program Table LOOP Read Reads the LOOP setting (number of repetitions). sss: Program step (PGMSTEP)	LOOPT123 = 12345 [CR] [LF]
LOOPTsss = nnnnn	Program Table LOOP Write Sets the LOOP setting (number of repetitions). sss: Program step (PGMSTEP) Setting: 1 ≤ nnnnn ≤ 99,999	OK
NEXTTsss	Program Table NEXT Read Reads the NEXT setting (link destination). sss: Program step (PGMSTEP)	NEXTT123 = 12345 [CR] [LF] NEXTT123 = END [SP] [SP] [CR] [LF]
NEXTTsss = nnn	Program Table NEXT Write Sets the NEXT setting (link destination). sss: Program step (PGMSTEP) Settings: 0 ≤ nnn ≤ 127: Program step (PGMSTEP) END: End	OK

6.7.5 Program Table Operation Commands

The following table shows the Program Table Operation Commands.

Table 6.5 Program Table Operation Commands

Serial Command	Function	Positive Response
STARTsss	Program Table Operation Start Starts program table operation from program step sss. sss: Program step (PGMSTEP) When program table operation has been interrupted by the STOP command or other method, the STARTsss command can be executed to cancel that operation and simultaneously start a new program table operation from program step sss.	OK
START	Program Table Operation Restart When program table operation has been interrupted by the STOP command or other method, the START command can be executed to restart that operation (Clear Hold). If program table operation was cancelled or ended, the START command will start a new program table operation from the program step (sss) that was specified in the last STARTsss command, i.e., START will repeat the last STARTsss command.	OK
STOP	Program Table Operation Interruption Interrupts a program table operation. When a positioning operation is in progress, the remainder of the operation (remaining distance) is put on hold.	OK
PGMRES	Program Table Operation Reset When program table operation has been interrupted by the STOP command or other method, the PGMRES command can be executed to cancel that operation (reset program table operation.)	OK

6.7.6 Zone Table Setup Commands

The following table shows the Zone Table Setup Commands.

Table 6.6 Zone Table Setup Commands

Serial Command	Function	Positive Response
ZONESTORE	Zone Table Save Saves the zone table in flash memory. Once ZONESTORE is executed, the zone table will be retained after the control power supply is turned OFF or the RES command is executed. Since the zone table is stored in flash memory, this command must not be executed frequently.	OK
ZONEINIT	Zone Table Initialization Resets all values in the zone table to their factory default settings.	OK
ZONEPTzz	Zone Table ZONEP Read Reads the ZONEP setting (positive side zone boundary position.) zz: Zone number (ZONE ID)	ZONEPT123 = +12345678 [CR] [LF]
ZONEPTzz = nnnnnnnn	Zone Table ZONEP Write Sets the ZONEP setting (positive side zone boundary position.) zz: Zone number (ZONE ID) Settings: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999	OK
ZONENTzz	Zone Table ZONEN Read Reads the ZONEN setting (negative side zone boundary position.) zz: Zone number (ZONE ID)	ZONENT123 = +12345678 [CR] [LF]
ZONENTzz = nnnnnnnn	Zone Table ZONEN Write Sets the ZONEN setting (negative side zone boundary position.) zz: Zone number (ZONE ID) Settings: –99,999,999 ≤ nnnnnnnn ≤ +99,999,999	OK

6.7.7 Jog Speed Table Setup Commands

The following table shows the Jog Speed Table Setup Commands.

Table 6.7 Jog Speed Table Setup Commands

Serial Command	Function	Positive Response
JSPDSTORE	JOG Speed Table Save Saves the jog speed table in flash memory. Once JSPDSTORE is executed, the jog speed table will be retained after the control power supply is turned OFF or the RES command is executed. Since the jog speed table is stored in flash memory, this command must not be executed frequently.	OK
JSPDINIT	JOG Speed Table Initialization Resets all values in the jog speed table to their factory default settings.	OK
JSPDTdd	JOG Speed Table Read Reads the jog speed table setting for the specified number. dd: Jog speed number	JSPDT123 = 12345678 [CR] [LF]
JSPDTdd = nnnnnnnn	JOG Speed Table Write Sets the jog speed table setting for the specified number. dd: Jog speed number Settings: 1 ≤ nnnnnnnn ≤ 99,999,999	OK

6.7.8 Monitor and Auxiliary Function Commands

The following table shows the Monitor and Auxiliary Function Commands.

Table 6.8 Monitor and Auxiliary Function Commands

Serial Command	Function	Positive Response
ALM	Alarm or Warning Read	One of the following responses is returned depending on the status. • ALM [SP] A.xx [SP] [CR] [LF] (The "xx" is the SERVOPACK's alarm/ warning code.) • ALM [SP] ExxA [SP] [CR] [LF] (ExxA is the NS600's alarm code.) • ALM [SP] P-OT [SP] [CR] [LF] • ALM [SP] N-OT [SP] [CR] [LF] • ALM [SP] P-LS [SP] [CR] [LF] • ALM [SP] N-LS [SP] [CR] [LF] • ALM [SP] BB [SP] [SP] [SP] [CR] [LF] • ALM [SP] HOLD [SP] [CR] [LF] • ALM [SP] INPOS [CR] [LF] • ALM [SP] NEAR [SP] [CR] [LF] • ALM [SP] RUN [SP] [SP] [CR] [LF] • ALM [SP] . [SP] [SP] [SP] [SP] [CR] [LF]
ALMn	Alarm History Read ($0 \leq n \leq 9$)	One of the following responses is returned depending on the status (no alarm, SERVO-PACK alarm, or NS600 alarm). • ALM1 = NONE [CR] [LF] • ALM1 = A.xx [CR] [LF] • ALM1 = ExxA [CR] [LF]
ERR	Most Recent Error Read	One of the following responses is returned. A response of "NONE" indicates that no errors have occurred. • ERR [SP] NONE [SP] [CR] [LF] • ERR [SP] ExxE [SP] [CR] [LF]
IN1	SGDH Input Signal Monitor	IN1 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON Bit 0: /S-ON Bit 1: /SEL5 Bit 2: P-OT Bit 3: N-OT Bit 4: /DEC Bit 5: /SEL6 Bit 6: /RGRT Bit 7: Always 0

Table 6.8 Monitor and Auxiliary Function Commands (cont'd)

Serial Command	Function	Positive Response
IN2	NS600 Input Signal Monitor	IN2 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON Bit 0: /MODE 0/1 Bit 1: /START-STOP; /HOME Bit 2: /PGMRES; /JOGP Bit 3: /SEL0; /JOGN Bit 4: /SEL1; /JOG0 Bit 5: /SEL2; /JOG1 Bit 6: /SEL3; /JOG2 Bit 7: /SEL4; /JOG3
IN2TESTbbbbbbbb	NS600 Input Signal Reservation The actual signal is ignored and the input signal is forcibly set to the specified status. This command is used to test operation when the actual signal line is not connected. b = 0: Photocoupler OFF b = 1: Photocoupler ON Bit 0: /MODE 0/1 Bit 1: /START-STOP; /HOME Bit 2: /PGMRES; /JOGP Bit 3: /SEL0; /JOGN Bit 4: /SEL1; /JOG0 Bit 5: /SEL2; /JOG1 Bit 6: /SEL3; /JOG2 Bit 7: /SEL4; /JOG3 IN2TESTEND: Return to actual signal status. Note: Error E56E will occur if fewer than 8 digits (bbbbbbbb) are specified in the command.	OK
OUT1	SGDH Output Signal Monitor	OUT1 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON Bit 0: ALM Bit 1: /WRN Bit 2: /BK Bit 3: /S-RDY Bit 4: ALO1 Bit 5: ALO2 Bit 6: ALO3 Bit 7: Always 0

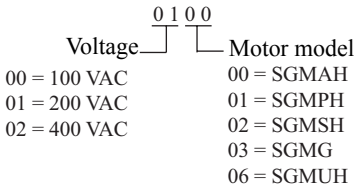
Table 6.8 Monitor and Auxiliary Function Commands (cont'd)

Serial Command	Function	Positive Response
OUT2	NS600 Output Signal Monitor	OUT2 = 01010101 [CR] [LF] 0: Photocoupler OFF 1: Photocoupler ON Bit 0: /INPOSITION Bit 1: /POUT0 Bit 2: /POUT1 Bit 3: /POUT2 Bit 4: /POUT3 Bit 5: /POUT4 Bit 6: Always 0 Bit 7: Always 0
OUT2TESTbbbbbb	NS600 Output Signal Reservation Forcibly sets the output signals to the specified status. This command is used to check wiring. b = 0: Photocoupler OFF b = 1: Photocoupler ON Bit 0: /INPOSITION Bit 1: /POUT0 Bit 2: /POUT1 Bit 3: /POUT2 Bit 4: /POUT3 Bit 5: /POUT4 Bit 6: Always 0 Bit 7: Always 0 OUT2TESTEND: Clears the forced signal status. Note: Error E56E will occur if fewer than 6 digits (bbbbbb) are specified in the command.	OK
POUT	POUT Monitor	POUT [SP] ANANZ [CR] [LF] Bit 0: /POUT0 Bit 1: /POUT1 Bit 2: /POUT2 Bit 3: /POUT3 Bit 4: /POUT4
PGMSTEP	Program PGMSTEP Pass Through Monitor	PGMSTEP = 12345 [CR] [LF]
EVTIME	Program EVENT Elapsed Time Monitor Monitors time elapsed (ms) for an event in program table operation.	EVTIME = 12345 [CR] [LF]
LOOP	Program LOOP Pass Through Monitor	LOOP = 12345 [CR] [LF]
MONn	Monitor Read ($1 \leq n \leq 11$) See following description of STS to RDST.	See following description of the responses for STS to RDST.

Table 6.8 Monitor and Auxiliary Function Commands (cont'd)

Serial Command	Function	Positive Response
STS or MON6	Status Flag Monitor	STS = 1010101 [CR] [LF] Bit 0: ON (1) when the /INPOSITION (positioning completed) signal is active. Bit 1: ON (1) when the NEAR (positioning near) signal is active. Bit 2: ON (1) when the DEN (positioning reference distribution) signal is active. Bit 3: ON (1) when positioning or program operation is interrupted (on hold). Bit 4: ON (1) during program operation. Bit 5: ON (1) when the current (torque) is being limited. Bit 6: ON (1) when the main power supply is ON.
PUN or MON1	Current Distributed Position Monitor	PUN = +12345678 [CR] [LF]
PFB or MON7	Current (Actual) Motor Position Monitor	PFB = +12345678 [CR] [LF]
POS or MON8	Target Position Monitor	POS = +12345678 [CR] [LF]
DST or MON9	Target Distance Monitor	DST = +12345678 [CR] [LF]
RPOS or MON10	Registration Target Position Monitor	RPOS = +12345678 [CR] [LF]
RDST or MON11	Registration Target Distance Monitor	RDST = +12345678 [CR] [LF]
NFB or MON3	Motor Speed Monitor [min^{-1}]	NFB = +12345678 [CR] [LF]
TREF or MON5	Torque Reference Monitor [%]	TREF = +12345678 [CR] [LF]
NREF or MON4	Speed Reference Monitor [min^{-1}]	NREF = +12345678 [CR] [LF]
PER or MON2	Position Error Monitor [Reference units]	PER = +12345678 [CR] [LF]
TRMS	Torque Load Ratio Monitor [%]	TRMS = +12345678 [CR] [LF]
RGRMS	Regeneration Load Ratio Monitor [%]	RGRMS = +12345678 [CR] [LF]
DBRMS	Dynamic-Brake Load Ratio Monitor [%]	DBRMS = +12345678 [CR] [LF]
TYPE	NS600 Type Code Display NS600 Type Code = 0600	TYPE = 00000600 [CR] [LF] (Displayed in hexadecimal.)
YSPEC	NS600 Y Spec. No. Display	YSPEC = 12345678 [CR] [LF]
VER	NS600 Firmware Version Display	VER = 00001234 [CR] [LF] (Displayed in hexadecimal.)
SVTYPE	SGDH Type Code Display SGDH Type Code = 02	SVTYPE = 00000002 [CR] [LF] (Displayed in hexadecimal.)
SVYSPEC	SGDH Y Spec. No. Display	SVYSPEC = 12345678 [CR] [LF]
SVVER	SGDH Firmware Version Display	SVVER = 0000123 [CR] [LF] (Displayed in hexadecimal.)

Table 6.8 Monitor and Auxiliary Function Commands (cont'd)

Serial Command	Function	Positive Response
MTTYPE	Motor Type Display  	MTTYPE = 00001234 [CR] [LF] (Displayed in hexadecimal.)
MTSIZE	Motor Capacity Display [10 W]	MTSIZE = 12345678 [CR] [LF]
PGTYPE	Encoder Model Code Display 000D: 13-bit incremental encoder 0011: 17-bit incremental encoder 0100: 16-bit absolute encoder 0111: 17-bit absolute encoder	PGTYPE = 00001234 [CR] [LF] (Displayed in hexadecimal.)
PGVER	Encoder Firmware Version Display	PGVER = 00001234 [CR] [LF] (Displayed in hexadecimal.)
STIFF	Rigidity Monitor	STIFF = 12345 [CR] [LF]
STIFFd	Rigidity Reservation ($1 \leq d \leq 10$)	OK
ABSPGRES	Absolute Encoder Reset	OK
MLTLIMSET	Multiturn Limit Setting	OK
ALMTRCCLR	Alarm Trace Clear	OK
INERTIA	Auto-tuning Inertia Display	INERTIA = 12345 [CR] [LF]
TUNESTORE	Auto-tuning Inertia Save	OK
CURZERO	Motor Current Zero Adjustment	OK

7

Using the Digital Operator

This chapter explains how to connect the Digital Operator to the NS600 and how to use the Digital Operator's various functions. All constant settings and motor operations can be performed by simple, convenient operations. Operate the Digital Operator as you read through this chapter.

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Un00A: Regeneration load ratio monitor ---------- 7-12
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Un80E: Serial command received character count - - - - - - - - - - - - - - - - - - 7-16
Un80F: Serial command received error character count - - - - - - - - - - - - - - 7-16
Un810: Serial command transmitted character trace - - - - - - - - - - - - - - - - 7-16
Un811: Serial command transmitted character count - - - - - - - - - - - - - - - - 7-16

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Fn000: Alarm traceback data display - 7-19
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Fn003: Zero-point search - 7-23
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Fn006: Alarm traceback data clear - 7-27
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Fn008: Absolute encoder reset - 7-29
Fn00C: Manual zero-adjustment of analog monitor output - - - - - - - - - - - - 7-31
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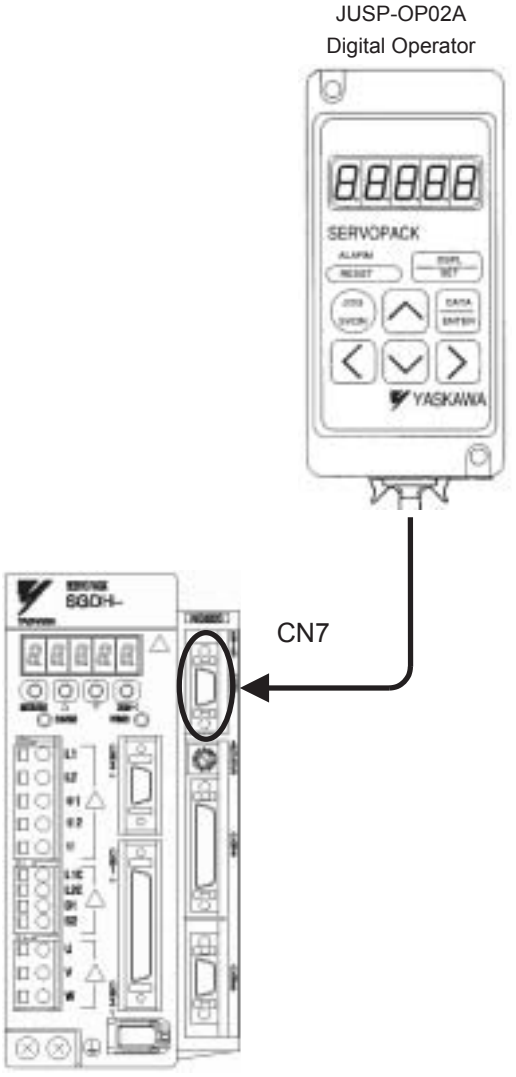
7.10 Operation during Jog Speed Table Editing Display - - - - - - 7-59

7.1 Connecting the Digital Operator

⚠ CAUTION
• The built-in Panel Operator cannot be used. Do not operate the built-in Panel Operator.

Connect the Hand-held JUSP-OP02A Digital Operator to connector CN7 on the NS600.

The SERVOPACK power supply can be left ON while connecting and disconnecting the Digital Operator's connector.

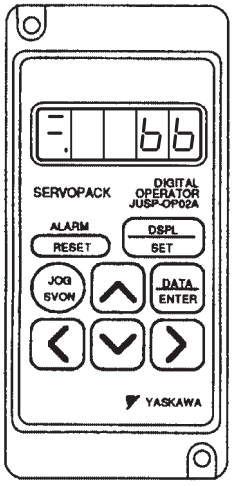


7.2 Digital Operator Functions

The Digital Operator can be used for parameter settings, operating references, and status displays.

This section provides information on the keys and their functions available from the initial displays.

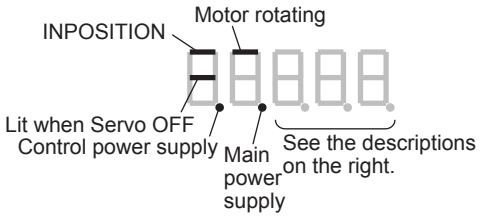
Hand-held
Digital Operator



Key	Name	Function
ALARM RESET	ALARM RESET	On the Status Display, use this key to reset alarms.
DSPL SET	DSPL/SET	Use this key for operations such as switching displays or executing auxiliary functions.
DATA ENTER	DATA/ENTER	Use this key for operations such as inputting numerical values.
∧	UP	Use these keys for operations such as incrementing and decrementing numerical values.
∨	DOWN	
>	LEFT	Use these keys for operations such as moving the cursor.
<	RIGHT	
JOG SVON	JOG SVON	Press this key to switch between Servo ON and Servo OFF status during JOG operation.

7.3 Status Display

On the Status Display, bit data and codes are displayed to indicate the status of SERVOPACK.

Display		Meaning
		Indicates Servo OFF status. (bb: Base Block)
		Indicates Servo ON status.
		Indicates P-OT status. Rotation in the forward direction is prohibited by the P-OT signal. (P-OT: Positive-side Over Travel)
		Indicates N-OT status. Rotation in the reverse direction is prohibited by the N-OT signal. (N-OT: Negative-side Over Travel)
		Indicates P-LS status. Rotation in the forward direction is prohibited by the limit setting in parameter Pn81B. (P-LS: Positive-side Limit Switch)
		Indicates N-LS status. Rotation in the reverse direction is prohibited by the limit setting in parameter Pn81C. (N-LS: Negative-side Limit Switch)
		Indicates Alarm or Warning status. (A.xx: SERVOPACK alarm or warning code)
		Indicates Alarm status. (ExxA: NS600's alarm code)
	2 seconds	Indicates an error. The error code is displayed for 2 seconds when an error has occurred. (ExxE: Error code)
	Flashing	Indicates that data is being saved to flash memory. Never turn OFF the control power supply while data is being saved.
	Flashing	Indicates that data is being initialized to the factory default settings. Never turn OFF the control power supply while settings are being initialized.

The ALARM RESET key can be used to reset alarms on the Status Display only.

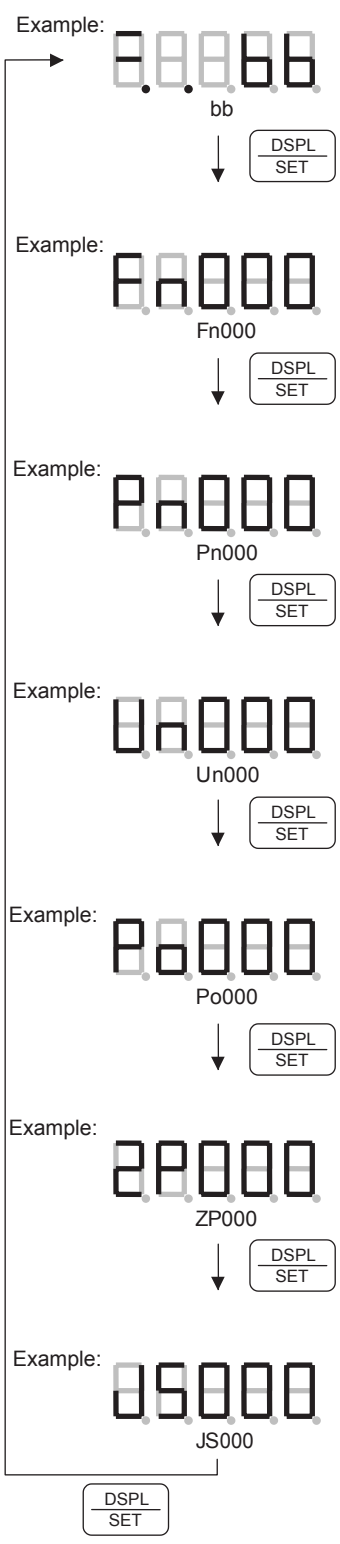
IMPORTANT

If an alarm has occurred, reset the alarm after eliminating the cause of the alarm. Refer to *Chapter 9 Troubleshooting* for details.

7.4 Switching between Basic Displays

Switch between the Digital Operator's basic displays for indicating the status of the SERVOPACK in operation and setting a variety of parameters and operation references.

The following basic displays are available: status display, auxiliary function, parameter editing, monitor, program table editing, zone table editing, and jog speed table editing displays. Select the basic display by pressing the DSPL/SET Key. The displays will appear in the following order as the key is pressed.



Status Display
Indicates the status with codes such as "bb" and "run." Refer to *7.3 Status Display* for details on codes.

The display changes each time the DSPL/SET is pressed.

Auxiliary Function Display
Indicates "Fn" and the selected function number. Refer to *7.7 Operations during Auxiliary Function Display* for details.

Parameter Editing Display
Indicates "Pn" and the selected parameter number. Refer to *7.5 Operation during Parameter Editing Display* for details.

Monitor Display
Indicates "Un" and the selected monitor number. Refer to *7.6 Operation during Monitor Display* for details.

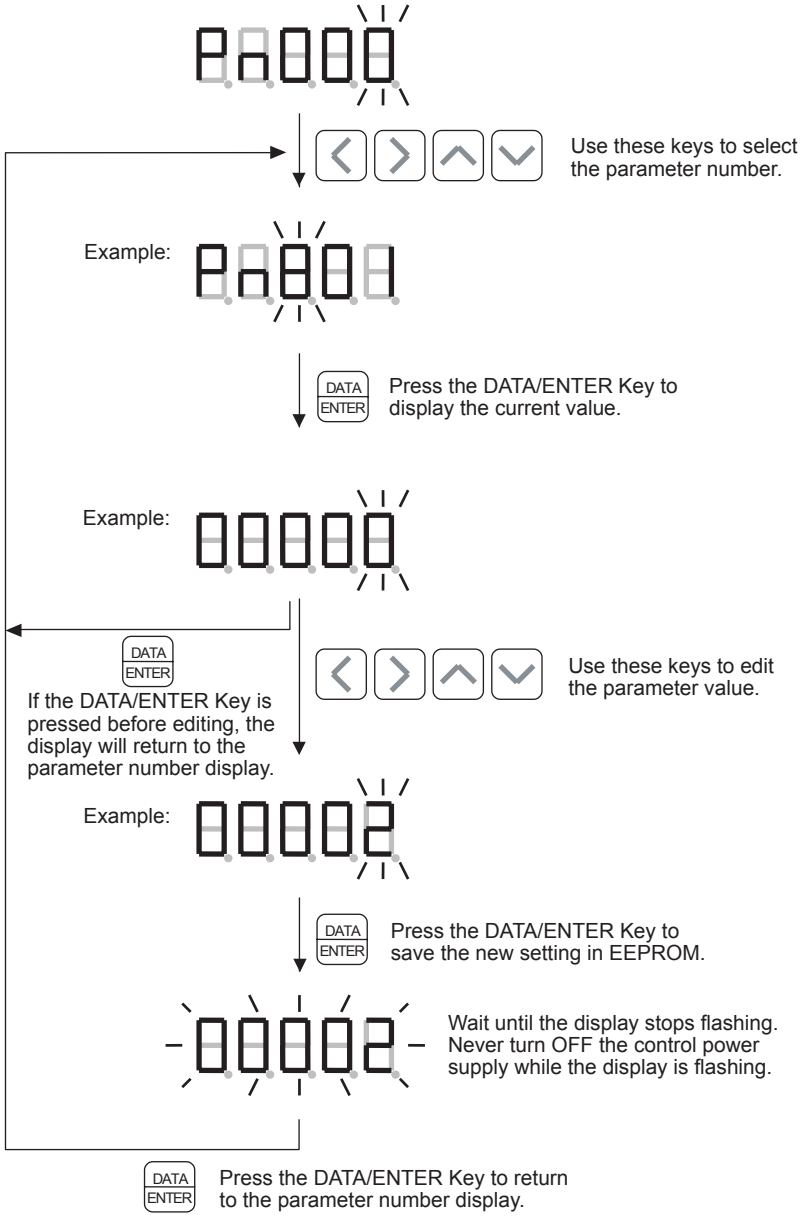
Program Table Editing Display
Indicates the mode, such as "Po" or "SP," and the selected program step number. Refer to *7.8 Operations during Program Table Editing Display* for details.

Zone Table Editing Display
Indicates the mode, i.e. "ZP" or "Zn," and the selected zone number. Refer to *7.9 Operation during Zone Table Editing Display* for details.

Jog Speed Table Editing Display
Indicates "JS" and the selected jog speed number. Refer to *7.10 Operation during Jog Speed Table Editing Display* for details.

7.5 Operation during Parameter Editing Display

Functions can be selected or adjusted by setting parameters. Refer to *Appendix A List of Parameters* for a list of parameters.


Use these keys to select the parameter number.
Example:
DATA ENTER
Press the DATA/ENTER Key to display the current value.
Example:
DATA ENTER
If the DATA/ENTER Key is pressed before editing, the display will return to the parameter number display.
Use these keys to edit the parameter value.
Example:
DATA ENTER
Press the DATA/ENTER Key to save the new setting in EEPROM.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
DATA ENTER
Press the DATA/ENTER Key to return to the parameter number display.

IMPORTANT

1. A function that automatically keeps the displayed value within the allowed setting range has been added for parameters with numbers Pn800 and higher. This function does not operate for parameters with numbers lower than Pn800. If you attempt to change to a value outside of the allowed range, the value will not change so keep the new values within range.
2. Some parameters can be changed during operation (online parameters) and others cannot (offline parameters). When an offline parameter's setting has been changed, the control power supply must be turned OFF and then ON again to enable the new setting.

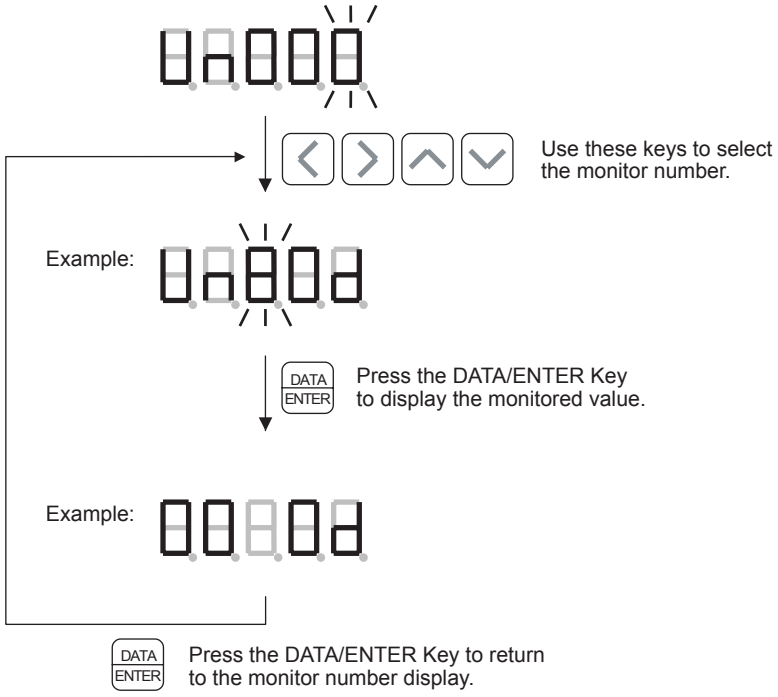
■ Displaying Parameters

This section explains how to display parameters. The following table shows the 4 data formats used for parameter settings.

Data Format	Display Method
5-digit Decimal	Example: 12,345
4-digit Hexadecimal	Example: 1,234 (Hexadecimal) This display is used for parameters that are set digit-by-digit. For example, the expression "Pn000.0" indicates the lowest digit setting of Pn000.
8-digit Decimal	Example: 12,345,678 Upper 3 digits Press the Left or Right Key to display the upper 3 digits or lower 5 digits. Lower 5 digits
8-digit Signed Decimal	Example: +12,345,678 "+" Upper 3 digits Press the Left or Right Key to display the upper 3 digits or lower 5 digits. Lower 5 digits

7.6 Operation during Monitor Display

The Monitor Display can be used for monitoring the reference values, I/O signal status, and SERVOPACK internal status.


Use these keys to select the monitor number.
Example:
DATA ENTER
Press the DATA/ENTER Key to display the monitored value.
Example:
DATA ENTER
Press the DATA/ENTER Key to return to the monitor number display.

There may be additional operations depending on the monitor number selected. Refer to the following description of each monitor number for details.

■ Contents of the Monitor Display

The following table shows contents of the monitor display.

Table 7.1 Monitor Displays

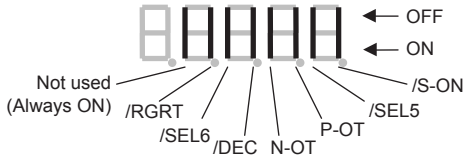
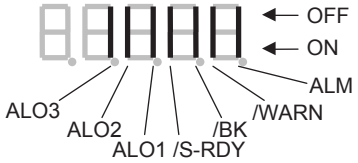
Monitor Number	Monitored Value	Display	Explanation
Un000	Actual motor speed [min^{-1}]	Example: 3,000 min^{-1}	Indicates the motor speed.
Un002	Internal torque reference [%]	Example: 100%	Indicates the torque. The torque level is displayed as a percentage of the rated torque (rated torque = 100%).
Un003	Rotation angle (pulses) [pulse]	Example: 8,191 pulses	Indicates the number of encoder phase-C pulses counted since the start point.
Un004	Rotation angle (electrical angle) [degrees]	Example: 90°	Indicates the motor's electrical angle.
Un005	SERVOPACK (CN1) input signal monitor	Example: 	Indicates the ON/OFF status of each signal. The ON/OFF logic is the ON/OFF status of the input pthoto-coupler.
Un006	SERVOPACK (CN1) output signal monitor	Example: 	Indicates the ON/OFF status of each signal. The ON/OFF logic is the ON/OFF status of the output transistor.
Un007	Position reference speed [min^{-1}]	Example: 3,000 min^{-1}	Indicates the reference speed of the position reference.

Table 7.1 Monitor Displays (cont'd)

Monitor Number	Monitored Value	Display	Explanation
Un008	Position error [reference units]	Example: 6,250 reference units	Indicates the position error. If the value exceeds ±9,999, "SAt" will be displayed.
Un009	Torque load ratio monitor [%]	Example: 100%	Indicates the executed torque over a 10-second interval. The torque level is displayed as a percentage of the rated torque (rated torque = 100%).
Un00A	Regeneration load ratio monitor [%]	Example: 30%	Indicates the power consumed by the regenerative resistor over a 10-second interval. The load rate is displayed as a percentage of the regenerative resistor's allowed power consumption.
Un00B	Dynamic-brake load ratio monitor [%]	Example: 10%	Indicates the power consumed by the dynamic brake over a 10-second interval. The load rate is displayed as a percentage of the dynamic brake's allowed power consumption.
Un00C	Position reference pulse counter [reference units]	Example: 01234567 reference units (hexadecimal) Press the Up or Down Key to display the upper 2 bytes or lower 2 bytes. The counter can be cleared by pressing the Up and Down Keys together.	Displays a position reference counter for monitoring.

Table 7.1 Monitor Displays (cont'd)

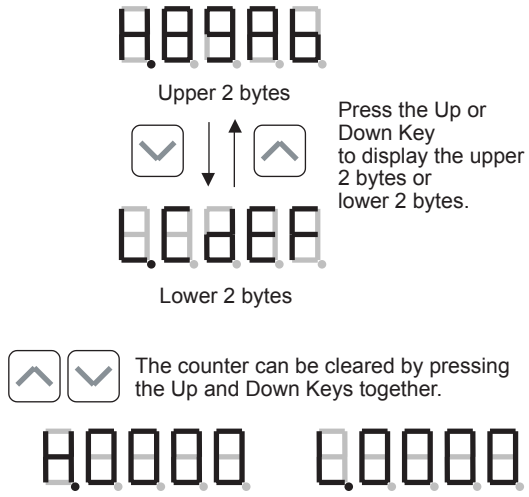
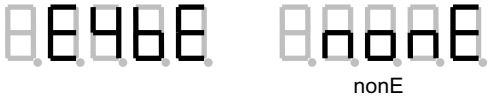
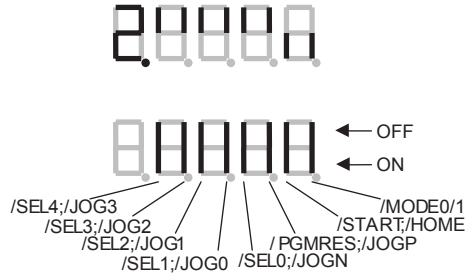
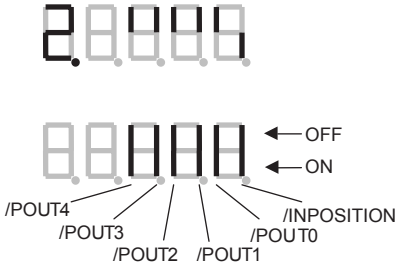
Monitor Number	Monitored Value	Display	Explanation
Un00D	Encoder pulse counter [pulses]	Example: 89ABCDEF pulses (hexadecimal) 	Displays an encoder pulse counter for monitoring.
Un800	Last error	Example: E4BE 	Displays the error code of the most recent error. If no errors have occurred, "nonE" will be displayed.
Un801	NS600 (CN4) input signal monitor	Example: 	Indicates the ON/OFF status of each signal. The ON/OFF logic is the ON/OFF status of the input photocoupler.
Un802	NS600 (CN4) output signal monitor	Example: 	Indicates the ON/OFF status of each signal. The ON/OFF logic is the ON/OFF status of the output photocoupler.

Table 7.1 Monitor Displays (cont'd)

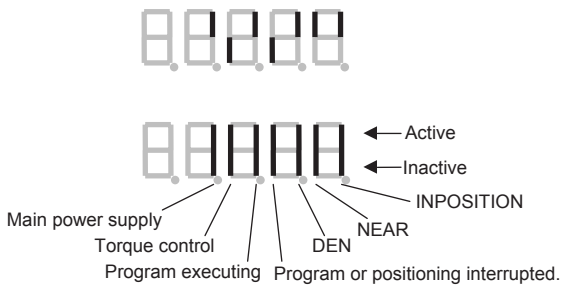
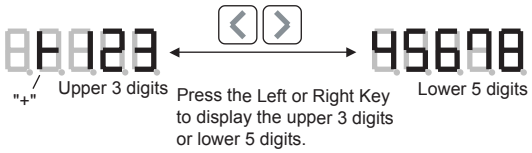
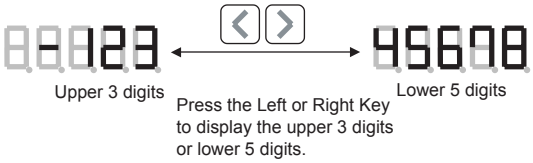
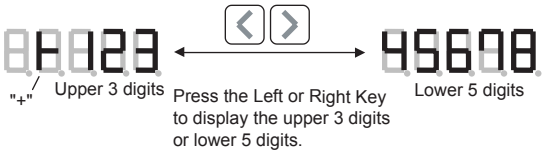
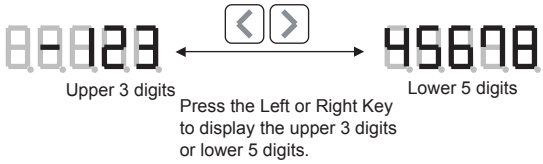
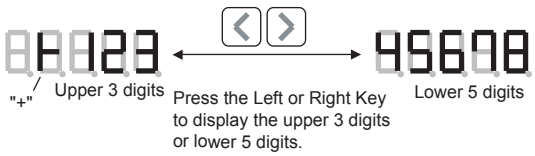
Monitor Number	Monitored Value	Display	Explanation
Un803	Status flag monitor	Example: 	Displays the flags that indicate status.
Un804	Current position reference monitor [reference units]	Example: +12,345,678 reference units 	Indicates the current position of the position reference.
Un805	Current motor position monitor [reference units]	Example: -12,345,678 reference units 	Indicates the current motor position.
Un806	Target position monitor [reference units]	Example: +12,345,678 reference units 	Indicates the target position for positioning.
Un807	Target distance monitor [reference units]	Example: -12,345,678 reference units 	Indicates the distance from the positioning start position to the target position.
Un808	Registration target position monitor [reference units]	Example: +12,345,678 reference units 	Indicates the registration target position that was determined when the registration signal latched.

Table 7.1 Monitor Displays (cont'd)

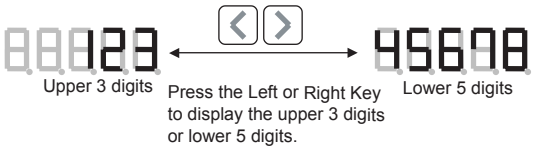
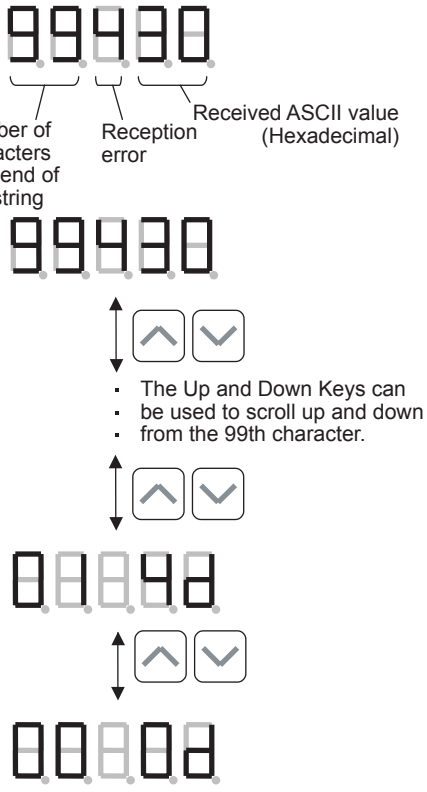
Monitor Number	Monitored Value	Display	Explanation
Un809	Registration distance monitor [reference units]	Example: 12,345,678 reference units  	Indicates the registration distance.
Un80A	Program step monitor	Example: 127 	Indicates the program step that is being executed. If the program is not being executed, "End" will be displayed.
Un80B	Program event time progress monitor [ms]	Example: 1,000 ms 	Indicates the time elapsed in the program table event.
Un80C	Program loop progress monitor [repetitions]	Example: 1 repetition 	Indicates the program table's loop execution progress.
Un80D	Serial command received character trace	 	Displays a record of the characters received through serial communications. Use the Up and Down Keys to scroll up and down between the 99th oldest character to the most recent character. Reception error: When reception errors have occurred, the following codes are added to indicate which errors have occurred. (A blank space indicates that no errors occurred.) 1: Overrun error 2: Framing error 4: Parity error For example, a value of "6" indicates that a framing error and parity error occurred.

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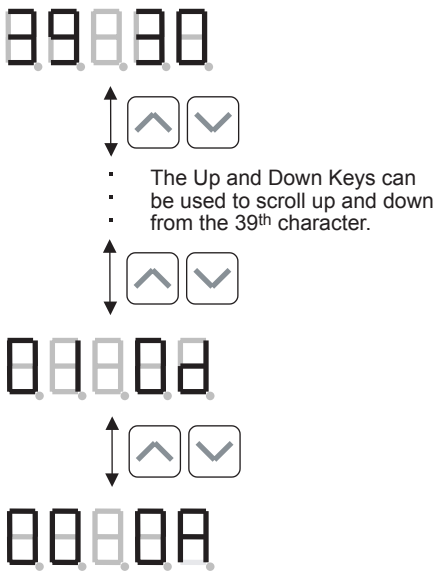
Table 7.1 Monitor Displays (cont'd)

Monitor Number	Monitored Value	Display	Explanation
Un80E	Serial command received character count	Example: 5 characters	Indicates the number of characters received through serial communications.
Un80F	Serial command received error character count	Example: 1 character	Indicates the number of characters received through serial communications that had reception errors.
Un810	Serial command transmitted character trace	Example: 	Displays a record of the characters transmitted through serial communications. Use the Up and Down Keys to scroll up and down between the 39th oldest character to the most recent character.
Un811	Serial command transmitted character count	Example: 17 characters	Indicates the number of characters transmitted through serial communications.

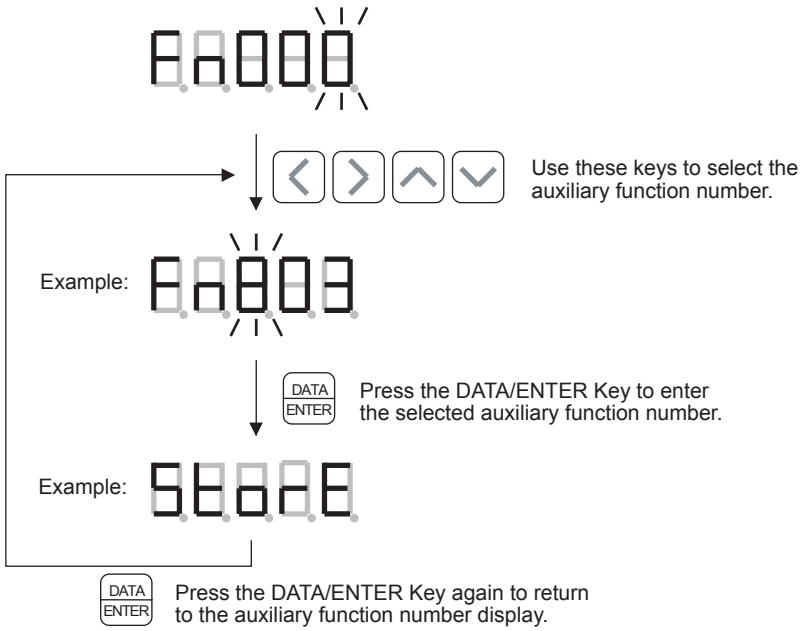
7.7 Operations during Auxiliary Function Display

The various auxiliary functions, such as jog operation or initialization of parameters, can be executed during the auxiliary function display.

The following table shows the auxiliary function numbers and the corresponding auxiliary functions.

Auxiliary Function No.	Function
Fn000	Alarm traceback data display
Fn001	Rigidity setting during online autotuning
Fn002	JOG mode operation
Fn003	Zero-point search
Fn004	(Reserved)
Fn005	Parameter settings initialization
Fn006	Alarm traceback data clear
Fn007	Write inertia ratio data
Fn008	Absolute encoder reset
Fn009	(Reserved)
Fn00A	(Reserved)
Fn00B	(Reserved)
Fn00C	Manual zero-adjustment of analog monitor output
Fn00D	Manual gain-adjustment of analog monitor output
Fn00E	Automatic offset-adjustment of motor current detection signal
Fn00F	Manual offset-adjustment of motor current detection signal
Fn010	Write-protection setting
Fn011	Motor model display
Fn012	SERVOPACK software version display
Fn013	Multiturn limit value setting change when a Multiturn Limit Disagreement Alarm (A.CC) occurs
Fn800	NS600 software version display
Fn801	NS600 model code (0600 Hex) display
Fn802	NS600 Y spec. number display
Fn803	Program table save
Fn804	Zone table save
Fn805	Jog speed table save
Fn806	Program table initialization
Fn807	Zone table initialization
Fn808	Jog speed table initialization

The following example shows how to select and execute an auxiliary function.


Use these keys to select the auxiliary function number.
Example:
DATA ENTER
Press the DATA/ENTER Key to enter the selected auxiliary function number.
Example:
DATA ENTER
Press the DATA/ENTER Key again to return to the auxiliary function number display.

The actual function displays and operations vary depending on the function selected. Refer to the description of each function for details.

■ Fn000: Alarm Traceback Data Display

This function displays the last ten alarms that have occurred.

Press the DATA/ENTER Key once to enter alarm traceback display.
Press the DATA/ENTER Key again to return to the auxiliary function number display.

Example:

Use the Up and Down Keys to scroll through the last 10 alarms (numbered 0 to 9).

Note: The following diagram shows the content of the alarm traceback display. If no alarms have occurred, “nonE” will be displayed.

nonE

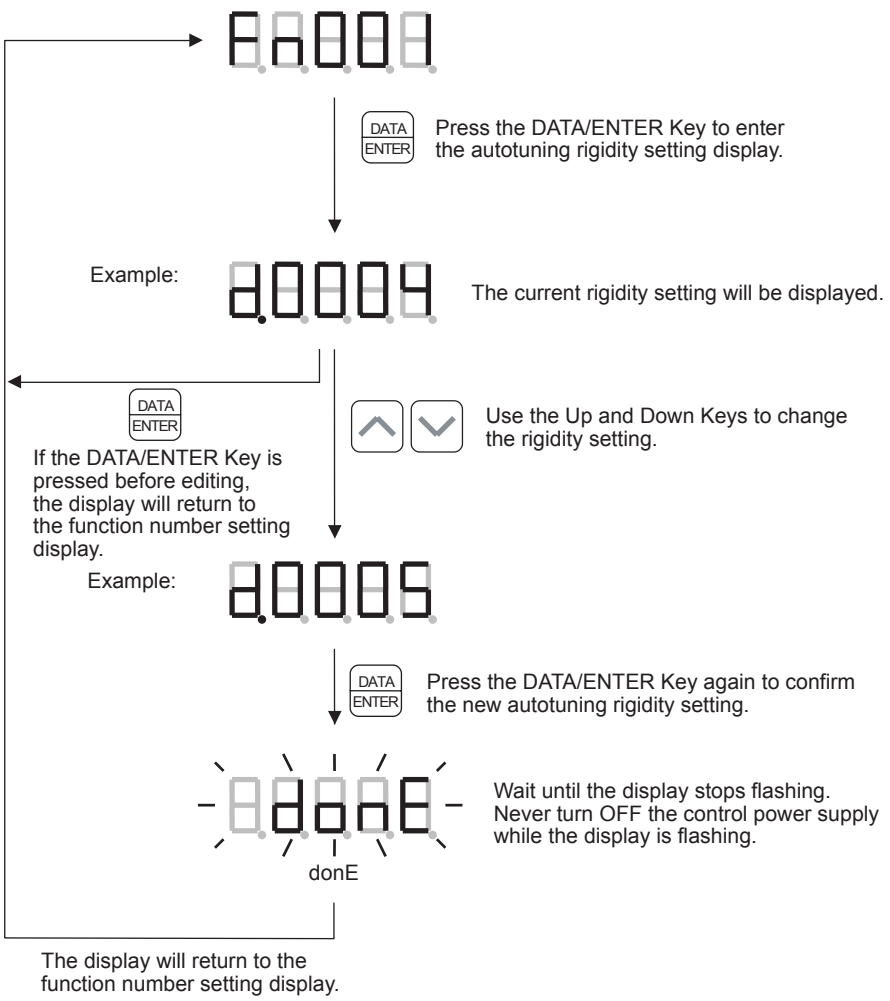
Alarm code

Alarm record number
(Alarm 0 is the most recent.)

7

■ Fn001: Rigidity Setting during Online Autotuning

This function sets the machine rigidity. When this function is executed, parameters Pn100, Pn101, Pn102, and Pn401 will be refreshed and saved to EEPROM.


DATA
ENTER
Press the DATA/ENTER Key to enter the autotuning rigidity setting display.
Example:
The current rigidity setting will be displayed.
DATA
ENTER
If the DATA/ENTER Key is pressed before editing, the display will return to the function number setting display.
Use the Up and Down Keys to change the rigidity setting.
Example:
DATA
ENTER
Press the DATA/ENTER Key again to confirm the new autotuning rigidity setting.
donE
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
The display will return to the function number setting display.

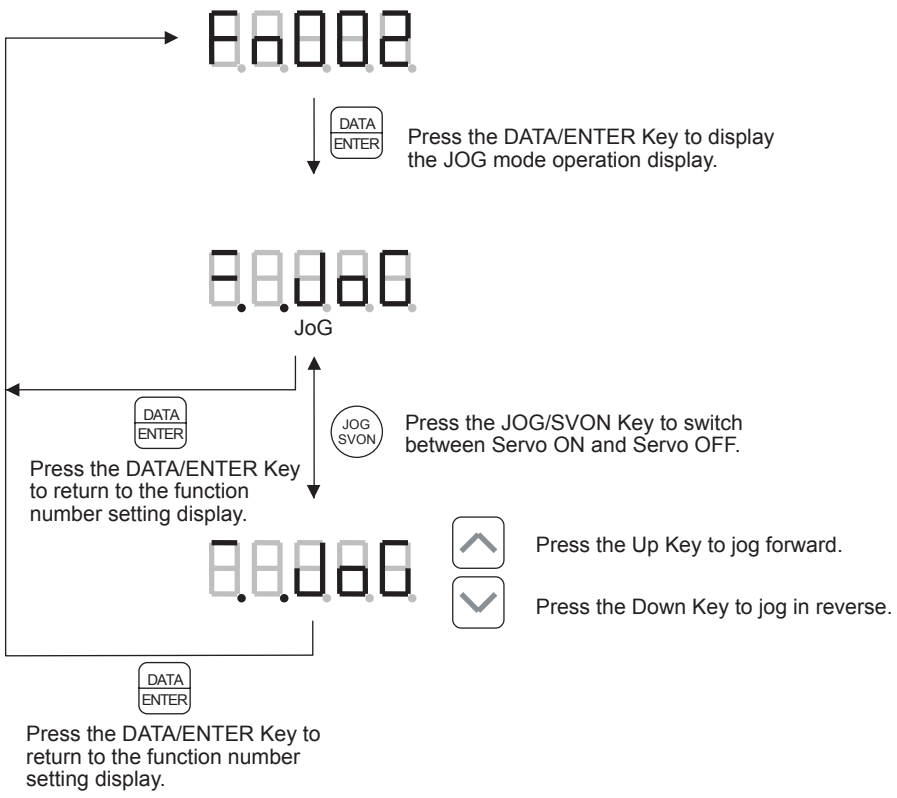
INFO

For details on autotuning operations, see *6.3 Autotuning* in the Σ-*II Series SGM□H/SGDH User's Manual Design and Maintenance* (Manual No.: SIE-S800-32.2).

■ Fn002: JOG Mode Operation

This function performs JOG mode operation.

⚠ CAUTION
• P-OT, N-OT, P-LS, and N-LS are not effective during JOG mode operation. (These signals and parameter settings prohibit forward and reverse operation.)


Fn002
DATA
ENTER
Press the DATA/ENTER Key to display the JOG mode operation display.
JoG
DATA
ENTER
JOG
SVON
Press the JOG/SVON Key to switch between Servo ON and Servo OFF.
Press the DATA/ENTER Key to return to the function number setting display.
Press the Up Key to jog forward.
Press the Down Key to jog in reverse.
DATA
ENTER
Press the DATA/ENTER Key to return to the function number setting display.

INFO

The speed can be changed with parameter Pn304. The factory default speed is 500 min^{-1}.

Related Errors

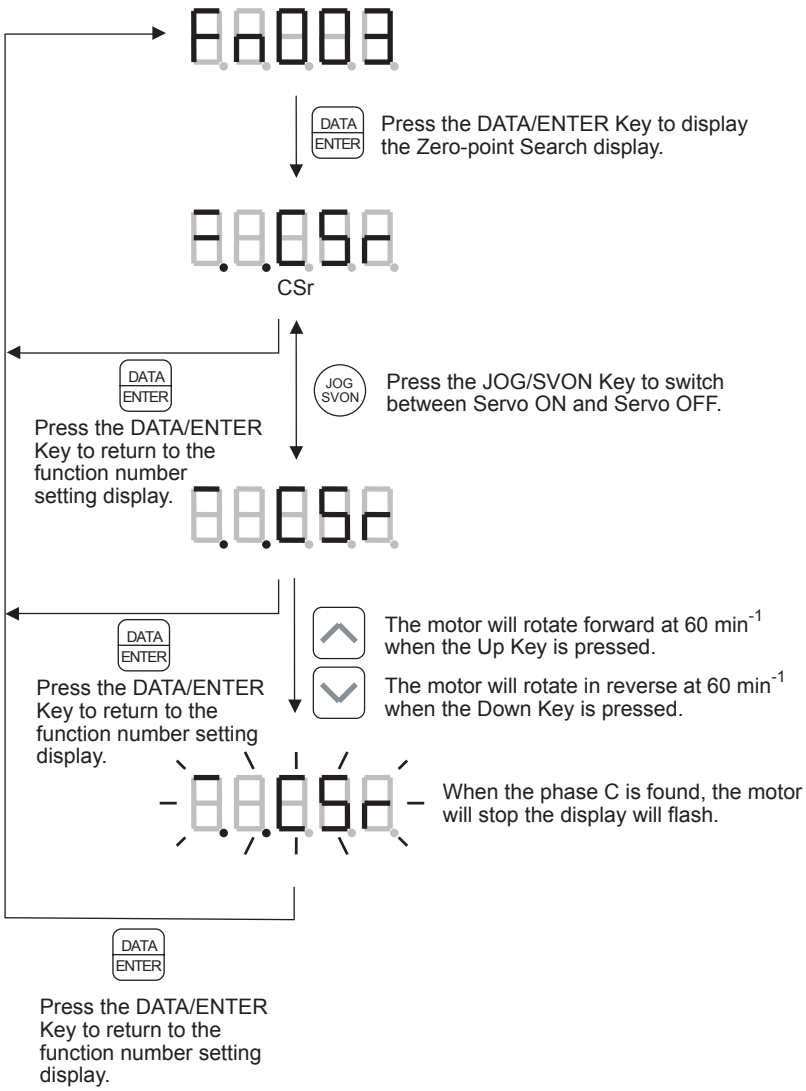
The following table shows the main errors related to JOG mode operation.

Error Display	Error Code and Name	Description
	E5AE: Execution Disabled while Servo ON Error	JOG operation cannot be executed while the Servo is ON. Switch the Servo OFF and try again.
	E5CE: Execution Disabled while Main Power OFF Error	JOG operation cannot be executed if the main power supply is OFF. Turn ON the main power supply and try again.
	E5EE: Execution Disabled during Program Operation Error	JOG operation cannot be executed while program operation is in progress or on hold (interrupted). Reset program operation and try again.

■ Fn003: Zero-point Search

This function operates the motor and searches for the encoder's phase C.

⚠ CAUTION
• P-OT, N-OT, P-LS, and N-LS are not effective during the Zero-point Search operation. (These signals and parameter settings prohibit forward and reverse operation.)


DATA ENTER
Press the DATA/ENTER Key to display the Zero-point Search display.
CSr
JOG SVON
Press the JOG/SVON Key to switch between Servo ON and Servo OFF.
Press the DATA/ENTER Key to return to the function number setting display.
The motor will rotate forward at 60 min-1 when the Up Key is pressed.
The motor will rotate in reverse at 60 min-1 when the Down Key is pressed.
Press the DATA/ENTER Key to return to the function number setting display.
When the phase C is found, the motor will stop the display will flash.
Press the DATA/ENTER Key to return to the function number setting display.

Related Errors

The following table shows the main errors related to the Zero-point Search operation.

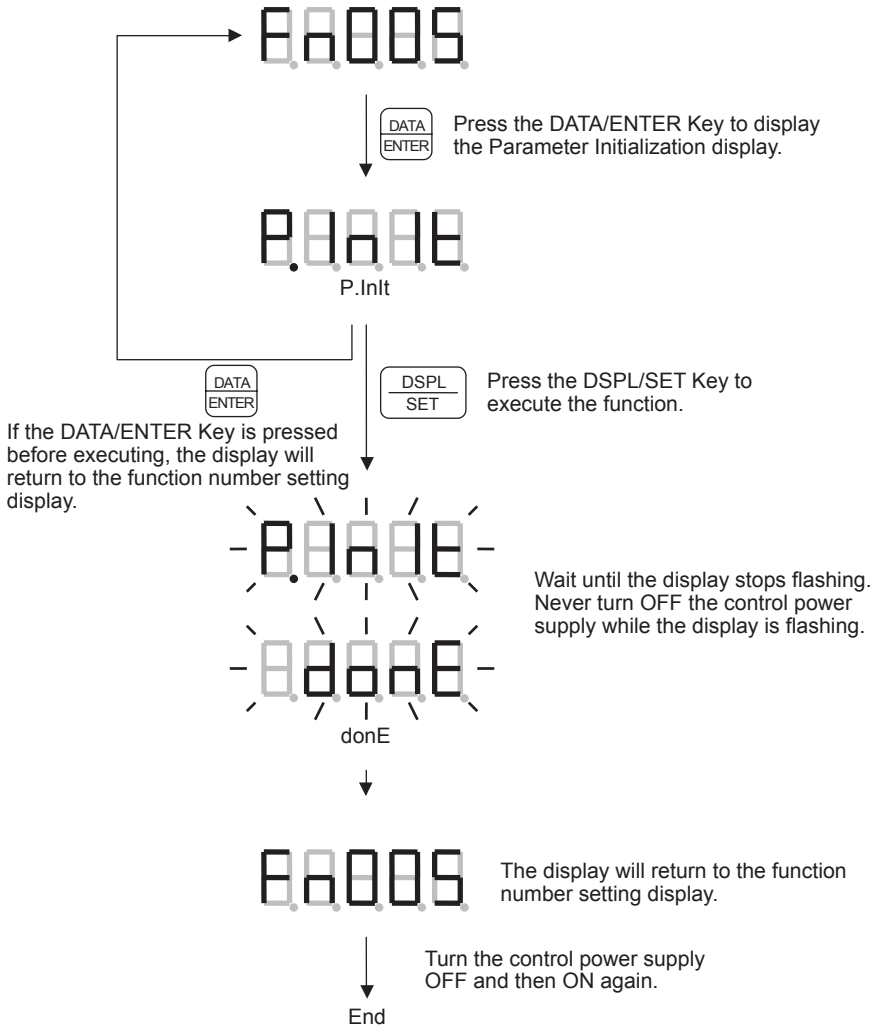
Error Display	Error Code and Name	Description
	E5AE: Execution Disabled while Servo ON Error	Zero-point Search operation cannot be executed while the Servo is ON. Switch the Servo OFF and try again.
	E5CE: Execution Disabled while Main Power OFF Error	Zero-point Search operation cannot be executed if the main power supply is OFF. Turn ON the main power supply and try again.
	E5EE: Execution Disabled during Program Operation Error	Zero-point Search operation cannot be executed while program operation is in progress or on hold (interrupted). Reset program operation and try again.

■ Fn005: Parameter Settings Initialization

This function returns the parameters to their factory default settings.

IMPORTANT

The Servo must be OFF when this function is executed.


Fn005
DATA ENTER
Press the DATA/ENTER Key to display the Parameter Initialization display.
P.InIt
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL SET
Press the DSPL/SET Key to execute the function.
P.InIt
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
Fn005
The display will return to the function number setting display.
Turn the control power supply OFF and then ON again.
End

IMPORTANT

For a function whose settings has been changed, the control power supply must be turned OFF and then ON again to enable the new settings.

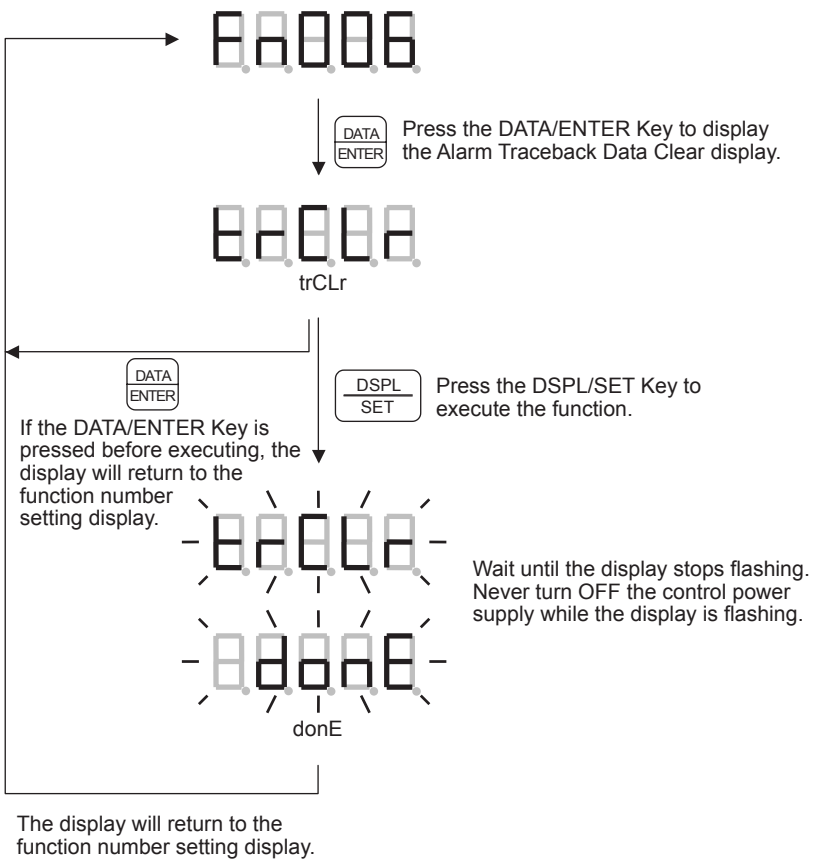
Related Errors

The following table shows the main errors related to the initialize parameter settings operation.

Error Display	Error Code and Name	Description
	E5AE: Execution Disabled while Servo ON Error	The parameter settings initialization operation cannot be executed while the Servo is ON. Switch the Servo OFF and try again.

■ Fn006: Alarm Traceback Data Clear

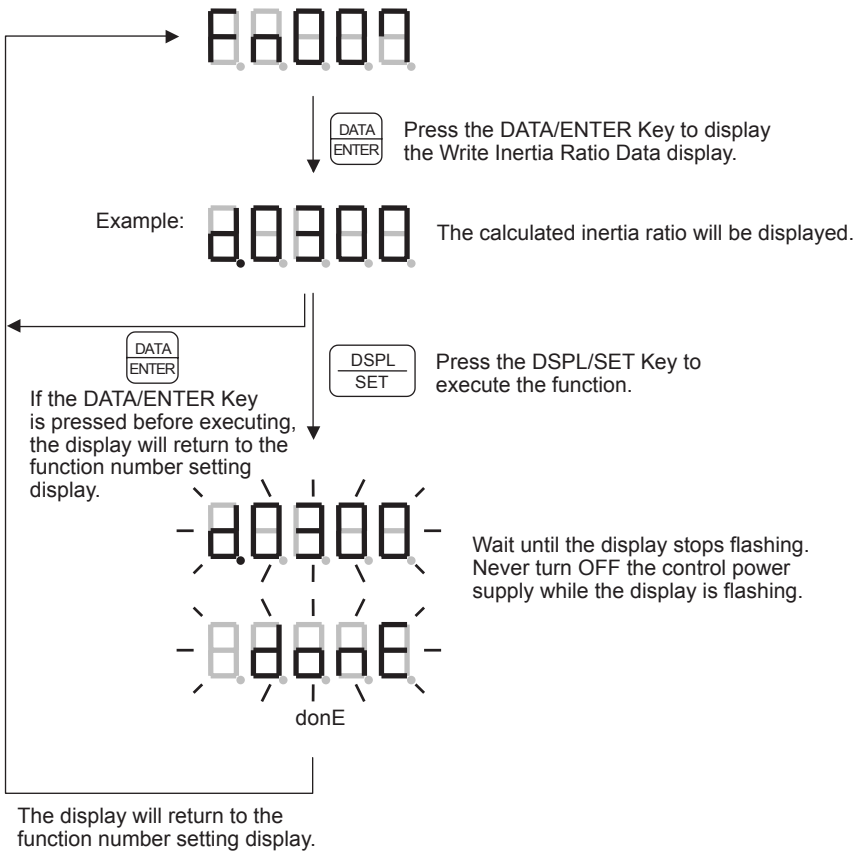
This function clears the record of alarms that have occurred.


Fn006
DATA
ENTER
Press the DATA/ENTER Key to display the Alarm Traceback Data Clear display.
trCLr
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

7

■ Fn007: Write Inertia Ratio Data

This function writes the inertia ratio (calculated by online autotuning) to the parameter. When this function is executed, parameter Pn103 is refreshed with the new inertia ratio data and saved in EEPROM.


DATA
ENTER
Press the DATA/ENTER Key to display the Write Inertia Ratio Data display.
Example:
The calculated inertia ratio will be displayed.
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

INFO

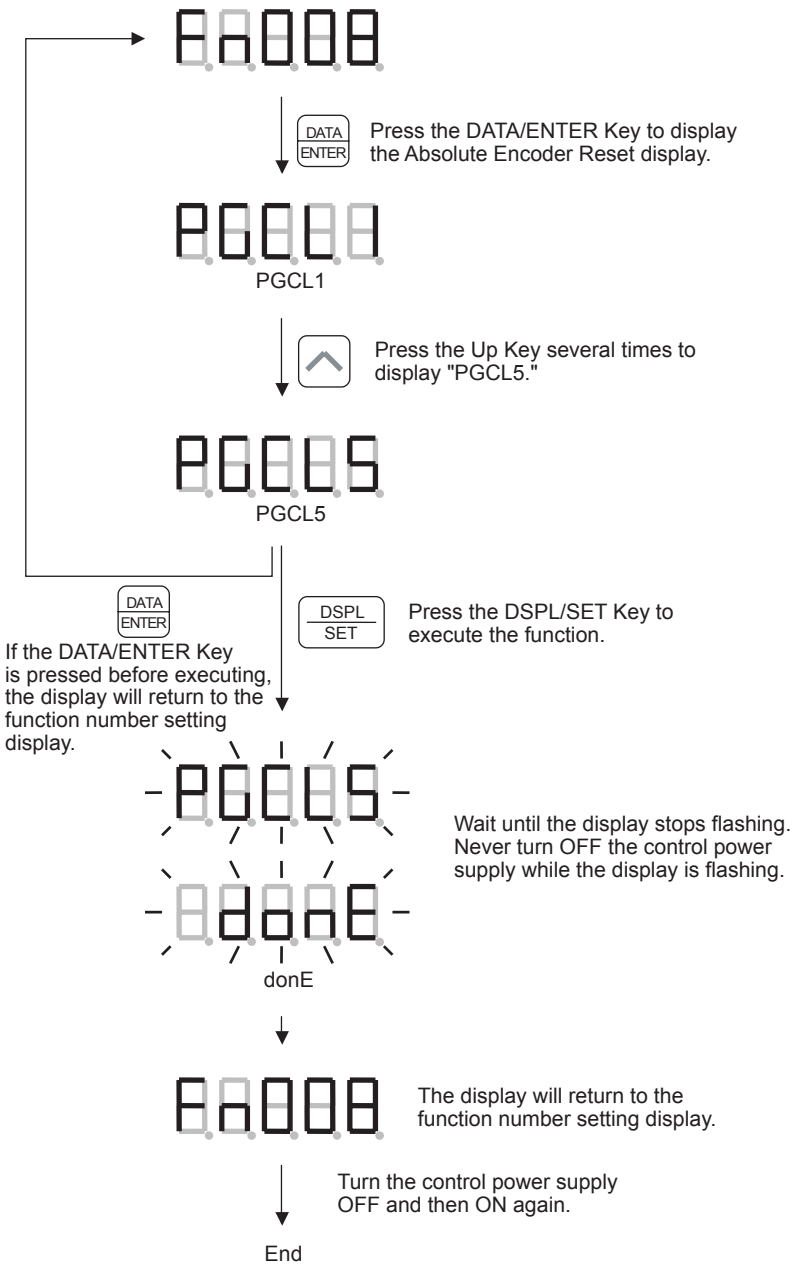
For details on autotuning operations, see *6.3 Autotuning* in the *Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance* (Manual No.: SIE-S800-32.2).

■ Fn008: Absolute Encoder Reset

This function resets the absolute encoder and clears the recorded position information.

Execute this function in the following cases:

- When starting up the machine for the first time
- When an Encoder Backup Alarm has occurred
- When the encoder cable was disconnected


Fn008
DATA ENTER
Press the DATA/ENTER Key to display the Absolute Encoder Reset display.
PGCL1
Press the Up Key several times to display "PGCL5."
PGCL5
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.
Turn the control power supply OFF and then ON again.
End

IMPORTANT

For a function whose settings has been changed, the control power supply must be turned OFF and then ON again to enable the new settings.

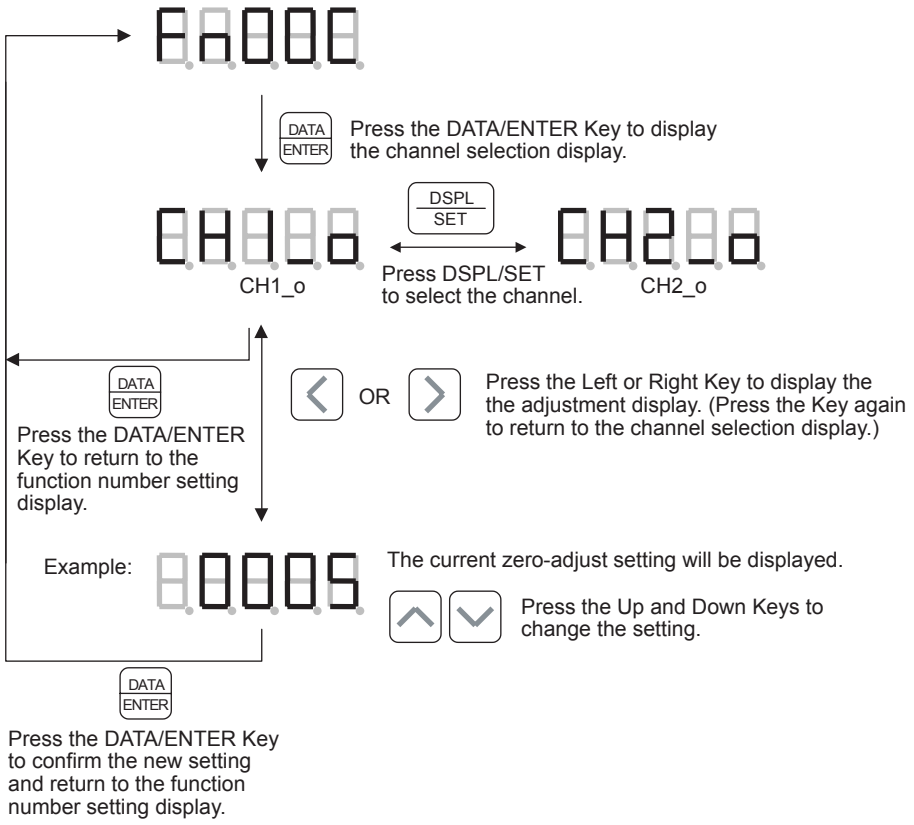
Related Errors

The following table shows the main errors related to the absolute encoder reset operation.

Error Display	Error Code and Name	Description
	E5AE: Execution Disabled while Servo ON Error	The absolute encoder reset operation cannot be executed while the Servo is ON. Switch the Servo OFF and try again.
	E61E: Encoder Mismatch Error	The function cannot be executed because the encoder is not an absolute encoder.
 nO OP	---	The operation failed. Try the operation again.

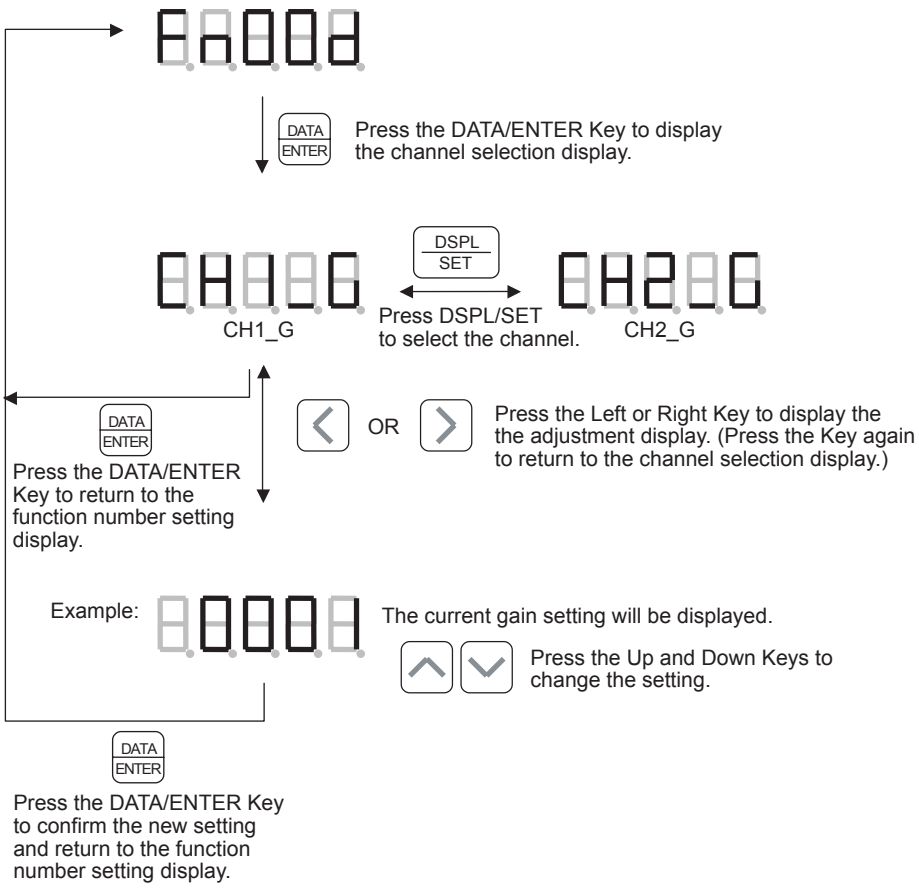
■ Fn00C: Manual Zero-adjustment of Analog Monitor Output

This function adjusts the analog monitor's zero setting (offset voltage).


DATA
ENTER
Press the DATA/ENTER Key to display the channel selection display.
DSPL
SET
CH1_o
Press DSPL/SET to select the channel.
CH2_o
DATA
ENTER
Press the DATA/ENTER Key to return to the function number setting display.
OR
Press the Left or Right Key to display the the adjustment display. (Press the Key again to return to the channel selection display.)
Example:
The current zero-adjust setting will be displayed.
Press the Up and Down Keys to change the setting.
DATA
ENTER
Press the DATA/ENTER Key to confirm the new setting and return to the function number setting display.

■ Fn00D: Manual Gain-adjustment of Analog Monitor Output

This function adjusts the analog monitor's gain.


Fn00d
DATA ENTER
Press the DATA/ENTER Key to display the channel selection display.
CH1_G
DSPL SET
Press DSPL/SET to select the channel.
CH2_G
DATA ENTER
Press the DATA/ENTER Key to return to the function number setting display.
OR
Press the Left or Right Key to display the the adjustment display. (Press the Key again to return to the channel selection display.)
Example:
The current gain setting will be displayed.
Press the Up and Down Keys to change the setting.
DATA ENTER
Press the DATA/ENTER Key to confirm the new setting and return to the function number setting display.

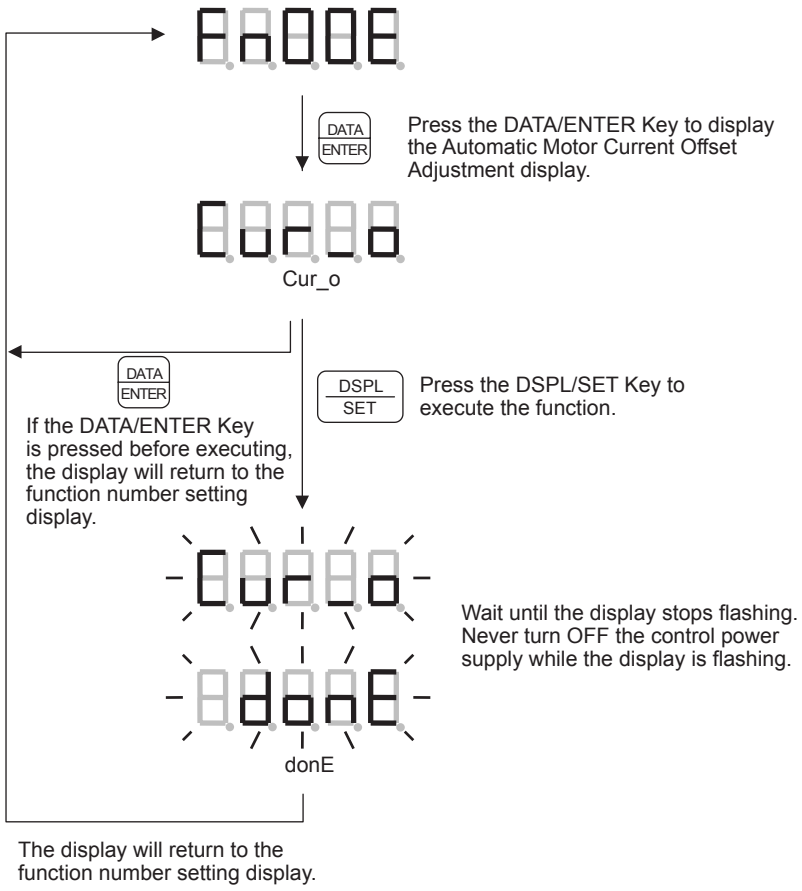
■ Fn00E: Automatic Offset-adjustment of Motor Current Detection Signal

This function automatically adjusts the motor current's zero setting (offset current).

The motor current detection offset is adjusted at Yaskawa before shipping. Normally, the user does not have to perform this adjustment. Perform this adjustment only if you require even higher accuracy because the torque ripple caused by current offset is causing unacceptable errors and you want to reduce the torque ripple even more.

IMPORTANT

If this function is executed carelessly, it may worsen the characteristics. Execute this function only when the generated torque ripple is clearly high compared to other SERVOPACKs.


Fn00E
DATA
ENTER
Press the DATA/ENTER Key to display the Automatic Motor Current Offset Adjustment display.
Cur_o
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

Related Errors

The following table shows the main errors related to the Automatic Offset-adjustment of the Motor Current Detection Signal operation.

Error Display	Error Code and Name	Description
	E5AE: Execution Disabled while Servo ON Error	The offset adjustment cannot be executed while the Servo is ON. Switch the Servo OFF and try again.
	E5CE: Execution Disabled while Main Power OFF Error	The offset adjustment cannot be executed if the main power supply is OFF. Turn ON the main power supply and try again.

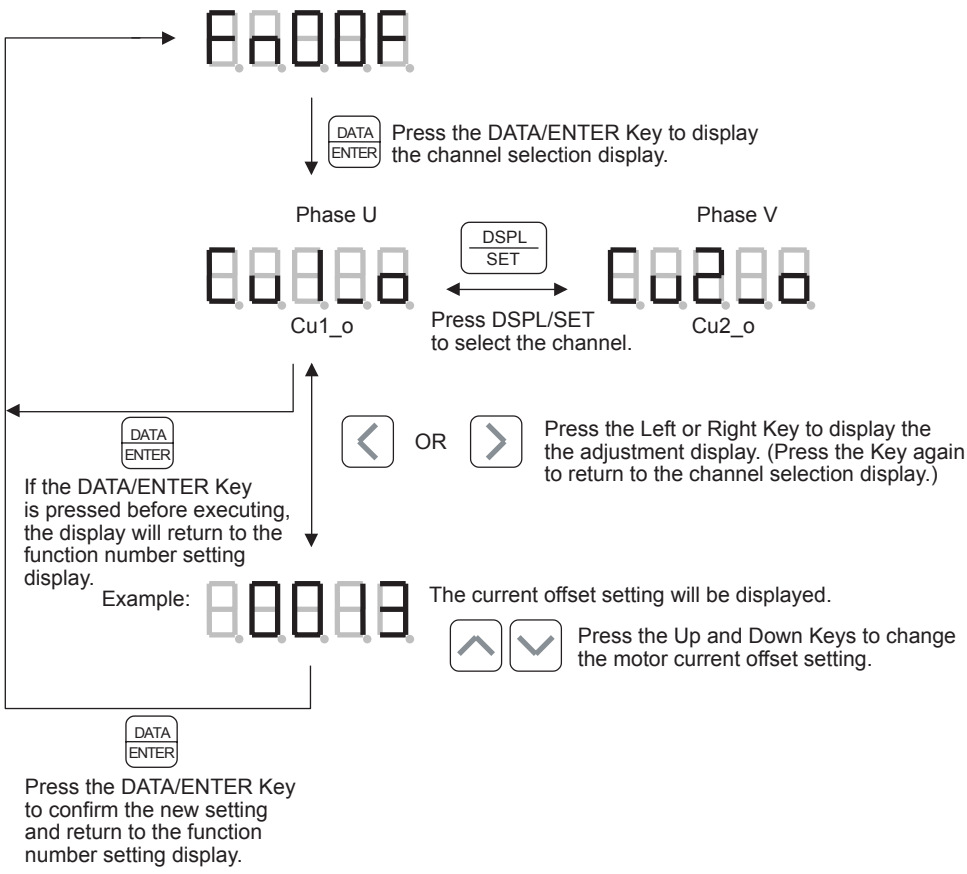
■ Fn00F: Manual Offset-adjustment of Motor Current Detection Signal

This function manually adjusts the motor current's zero setting (offset current).

The motor current detection offset is adjusted at Yaskawa before shipping. Normally, the user does not have to perform this adjustment. Perform this adjustment only if you require even higher accuracy because the torque ripple caused by current offset is causing unacceptable errors and you want to reduce the torque ripple even more.

IMPORTANT

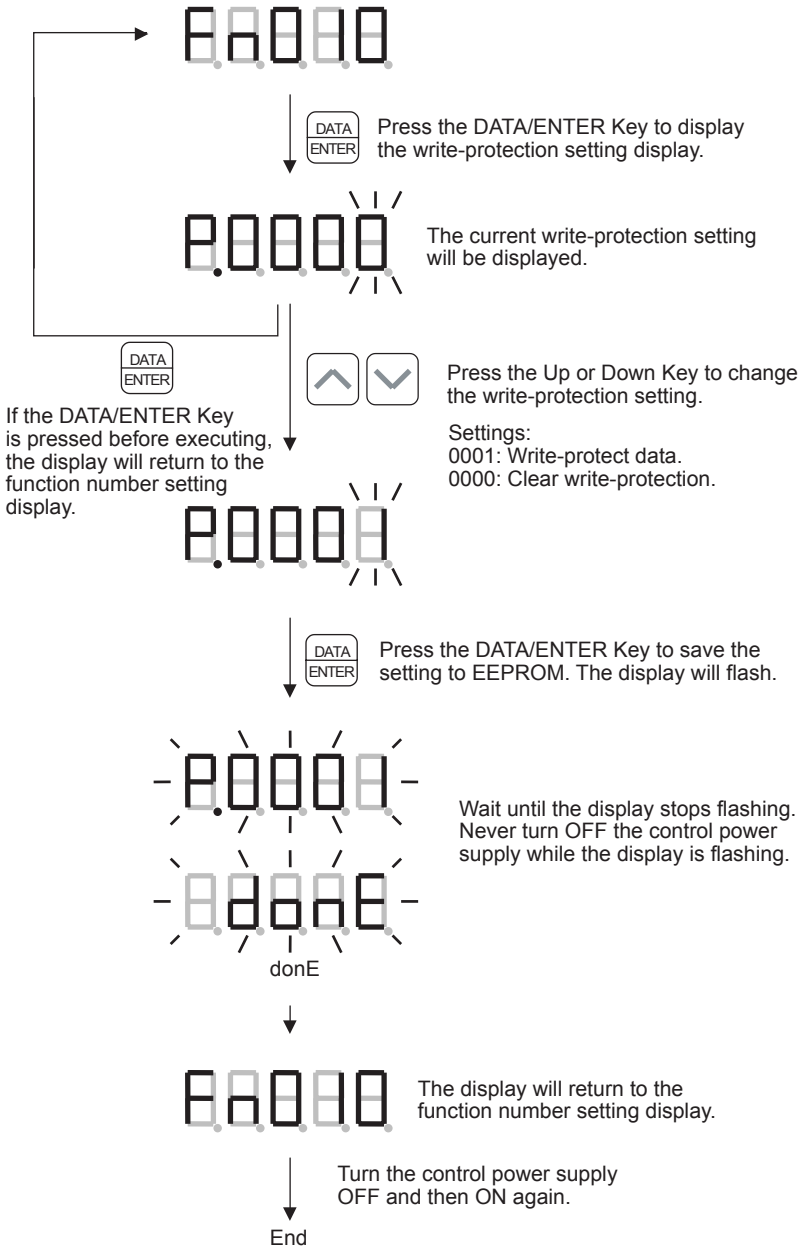
1. If this function is executed carelessly, it may worsen the characteristics. When the generated torque ripple is clearly high compared to other SERVOPACKs, execute the automatic offset-adjustment function (function number Fn00E).
2. When making manual adjustments, run the motor at a speed of approximately 100 min^{-1}, and adjust the offset until the torque monitor ripple is minimized. It is necessary to adjust the motor's phase U and phase V offsets alternately several times until these offsets are well balanced.


DATA ENTER
Press the DATA/ENTER Key to display the channel selection display.
Phase U
Phase V
DSPL SET
Cu1_o
Press DSPL/SET to select the channel.
Cu2_o
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
OR
Press the Left or Right Key to display the the adjustment display. (Press the Key again to return to the channel selection display.)
Example:
The current offset setting will be displayed.
Press the Up and Down Keys to change the motor current offset setting.
DATA ENTER
Press the DATA/ENTER Key to confirm the new setting and return to the function number setting display.

■ Fn010: Write-protection Setting

This function sets write-protection for various data.

If data is write-protected, it will not be possible to change the program table, zone table, jog speed table, or parameters. Some auxiliary functions will also be disabled.

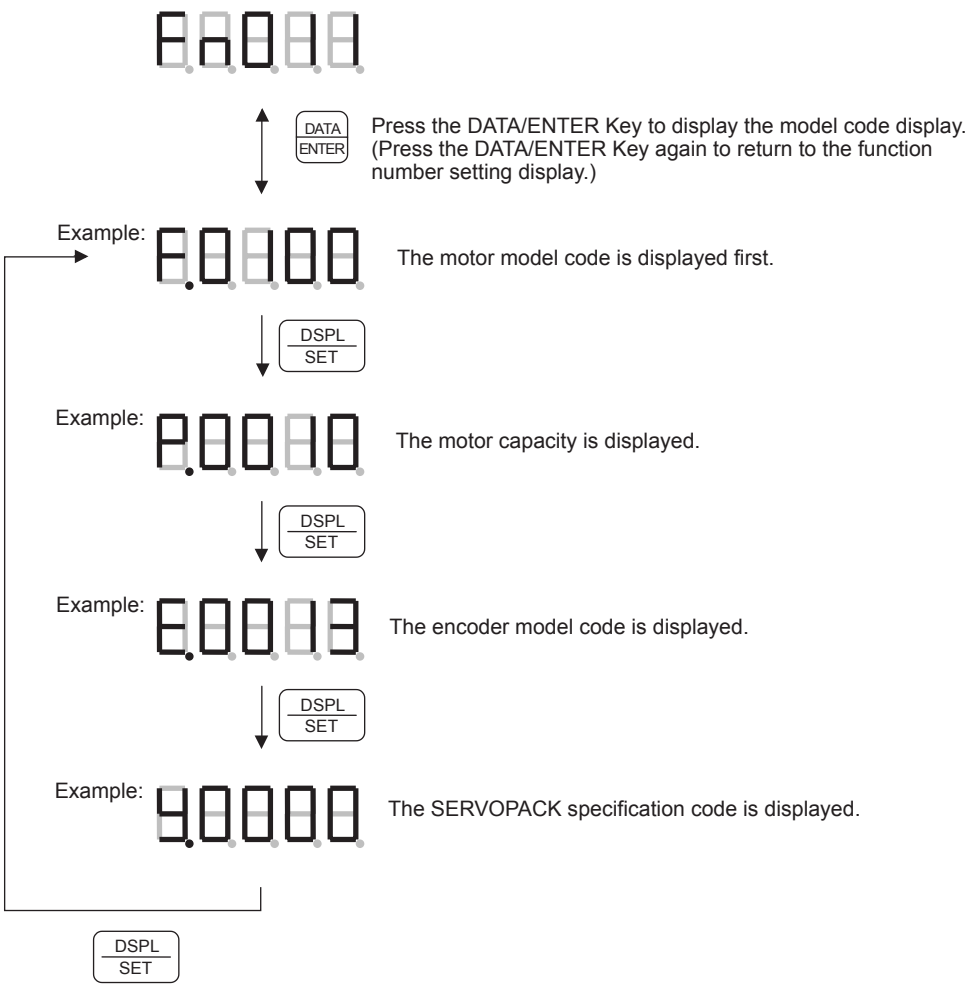

DATA
ENTER
Press the DATA/ENTER Key to display the write-protection setting display.
The current write-protection setting will be displayed.
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
Press the Up or Down Key to change the write-protection setting.
Settings:
0001: Write-protect data.
0000: Clear write-protection.
DATA
ENTER
Press the DATA/ENTER Key to save the setting to EEPROM. The display will flash.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.
Turn the control power supply OFF and then ON again.
End

IMPORTANT

For a function whose settings has been changed, the control power supply must be turned OFF and then ON again to enable the new settings.

■ Fn011: Motor Model Display

This function displays the motor model code, motor capacity, encoder model code, and the SERVOPACK special specification code (Y-specification code).

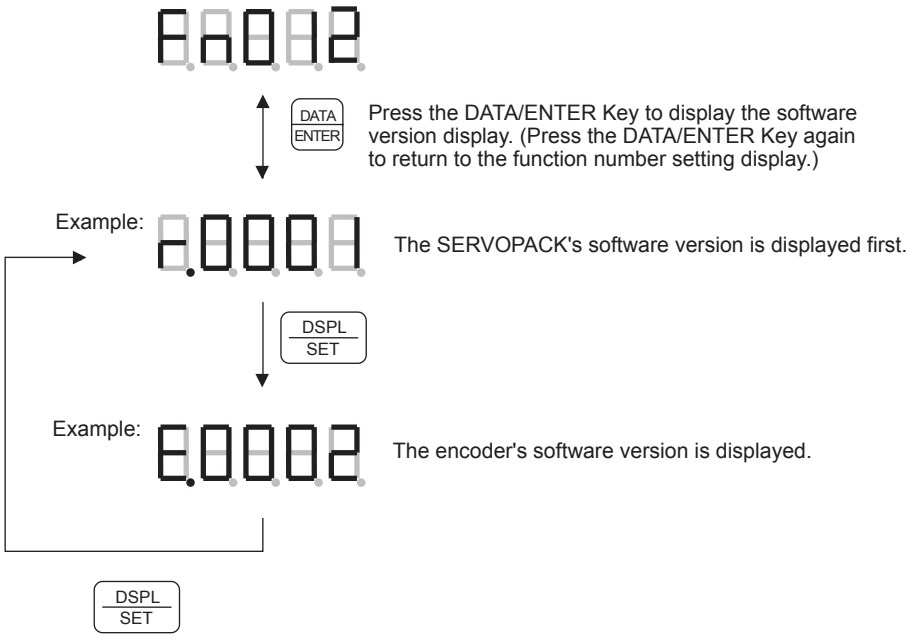


INFO

For details on the various codes displayed by this function, see *7.2.6 Checking the Motor Model* in the *Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance* (Manual No.: SIE-S800-32.2).

■ Fn012: SERVOPACK Software Version Display

This function displays the SERVOPACK and encoder software version.



■ Fn013: Change Multiturn Limit Value Setting

This function sets the multiturn limit value.

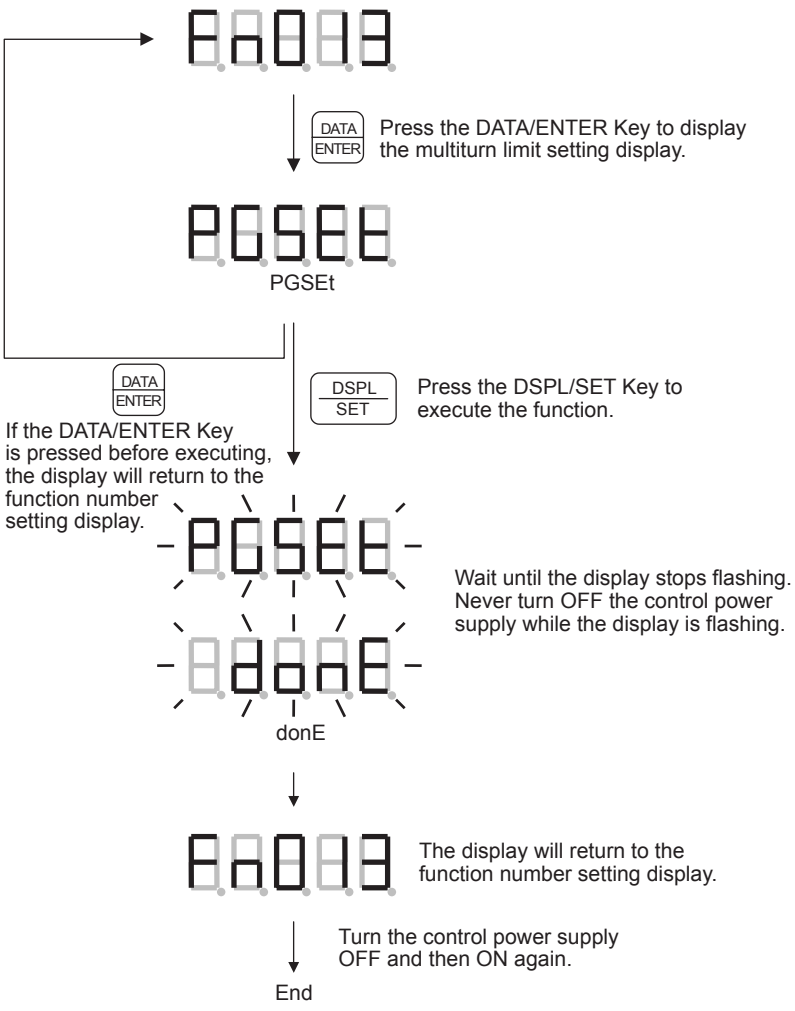
When this function is executed, the maximum multiturn value set in the absolute encoder is refreshed with the value in parameter Pn205.

This operation clears alarm A.CC (the Multiturn Limit Disagreement alarm).

⚠ WARNING

- The multiturn limit value must be changed only for special applications. Changing it inappropriately or unintentionally can be dangerous.
- If a Multiturn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK first to confirm that it is correct.

  If Fn013 is executed when an incorrect value is set in Pn205, an incorrect value will be set in the Encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting a dangerous situation where the machine will move to unexpected positions.


Fn013
DATA ENTER
Press the DATA/ENTER Key to display the multiturn limit setting display.
PGSEt
PGSEt
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
Fn013
The display will return to the function number setting display.
Turn the control power supply OFF and then ON again.
End

INFO For details on the multiturn limit setting, see *5.5.5 Multiturn Limit Setting*.

IMPORTANT For a function whose settings has been changed, the control power supply must be turned OFF and then ON again to enable the new settings.

Related Errors

The following table shows the main errors related to the change multiturn limit value setting operation.

Error Display	Error Code and Name	Description
	E61E: Encoder Mismatch Error	The function cannot be executed because the encoder is not an absolute encoder.
	E62E: No A.CC Alarm Occurred Error	The function cannot be executed if an A.CC alarm has not occurred. (Alarm A.CC occurs only when the setting stored in the encoder does not match the setting in parameter Pn205.)

■ Fn800: NS600 Software Version Display

This function displays the NS600's software version.

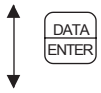
Press the DATA/ENTER Key to display the software version display. (Press the DATA/ENTER Key again to return to the function number setting display.)

Example:

The NS600's software version is displayed.

■ Fn801: NS600 Model Code Display

This function displays the NS600's model code.

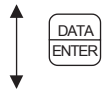


Press the DATA/ENTER Key to display the model code display. (Press the DATA/ENTER Key again to return to the function number setting display.)

The NS600's model code is displayed.

■ Fn802: NS600 Y Specification Number Display

This function displays the NS600's Y specification code.



Press the DATA/ENTER Key to display the NS600 Y specification code display. (Press the DATA/ENTER Key again to return to the function number setting display.)

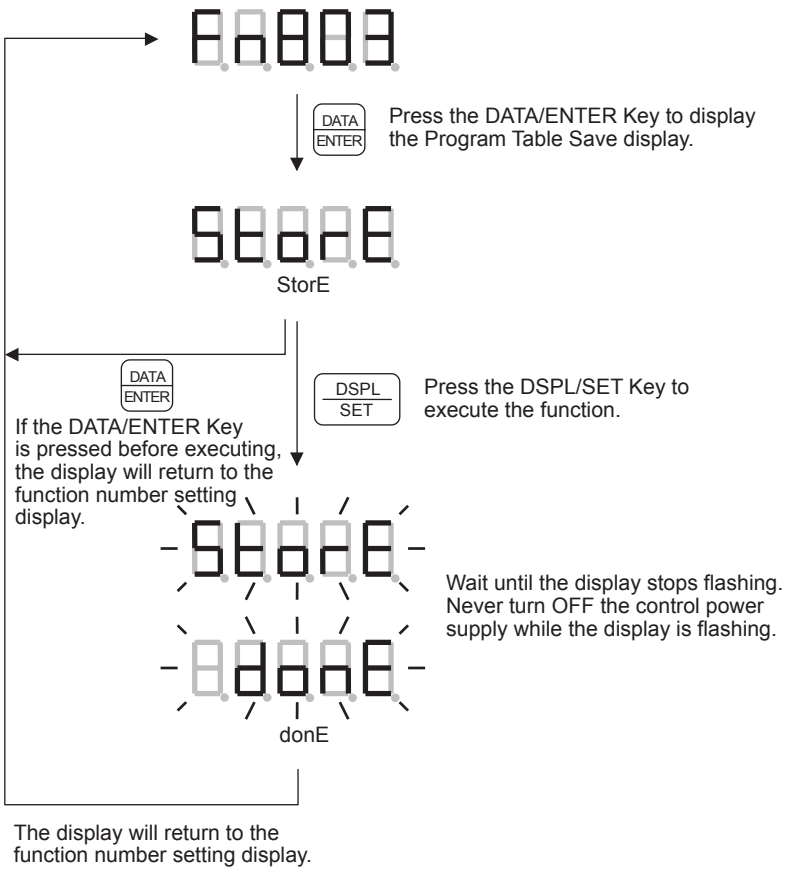
Example:

The NS600's Y specification code is displayed.

■ Fn803: Program Table Save

This function saves the program table to flash memory.

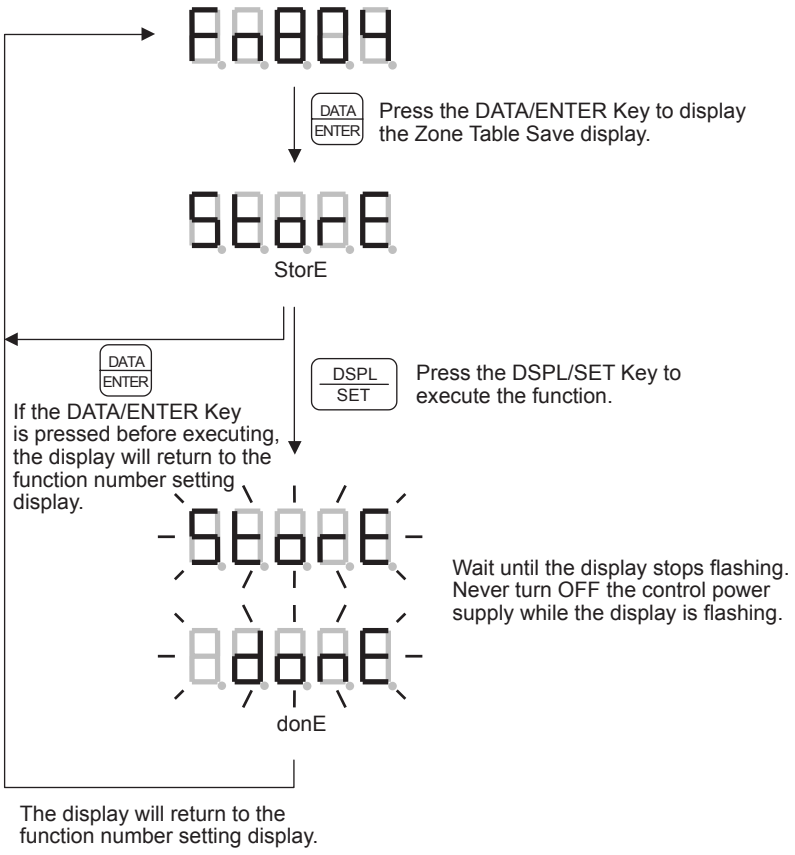
When this function is executed, the program table in RAM is saved to flash memory. Data saved in flash memory is retained even when the control power supply is turned OFF.


DATA
ENTER
Press the DATA/ENTER Key to display the Program Table Save display.
StorE
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

■ Fn804: Zone Table Save

This function saves the zone table to flash memory.

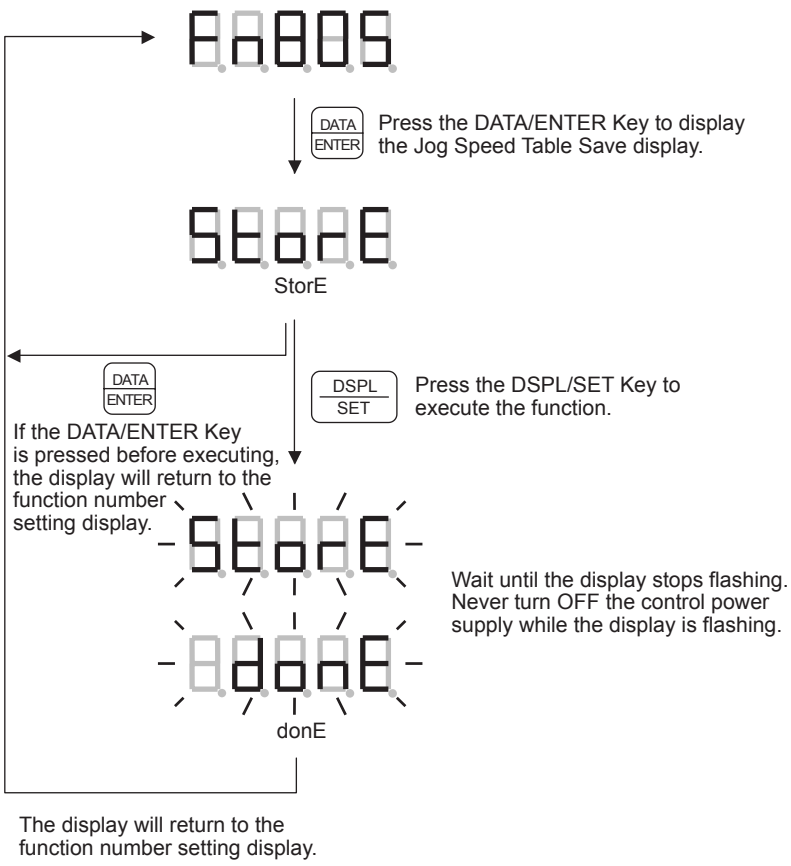
When this function is executed, the zone table in RAM is saved to flash memory. Data saved in flash memory is retained even when the control power supply is turned OFF.


Fn804
DATA ENTER
Press the DATA/ENTER Key to display the Zone Table Save display.
StorE
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL SET
Press the DSPL/SET Key to execute the function.
StorE
donE
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
The display will return to the function number setting display.

■ Fn805: Jog Speed Table Save

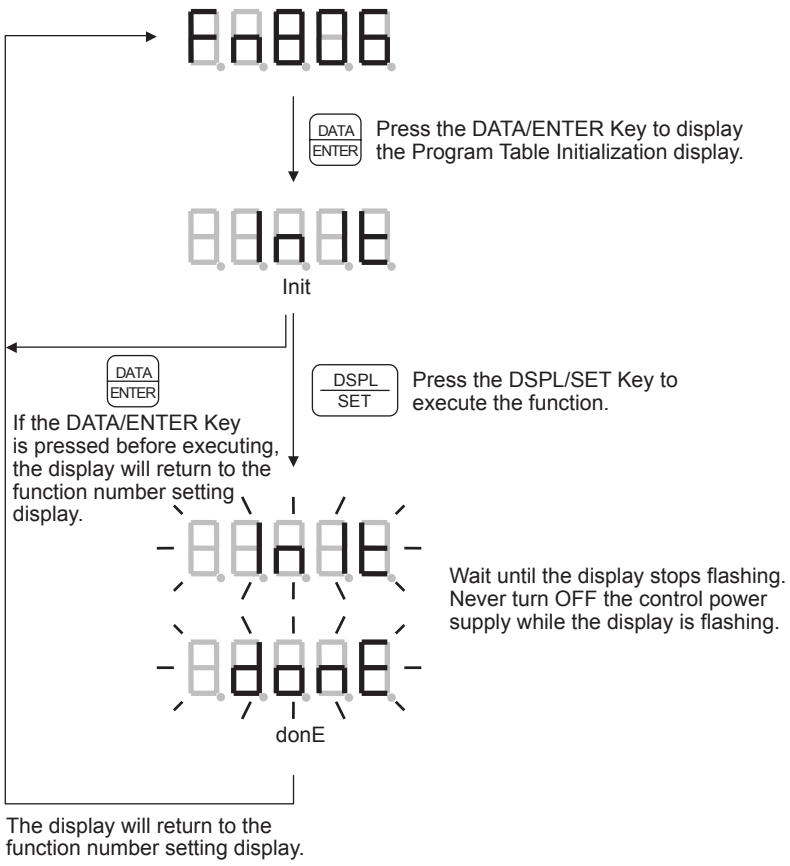
This function saves the jog speed table to flash memory.

When this function is executed, the jog speed table in RAM is saved to flash memory. Data saved in flash memory is retained even when the control power supply is turned OFF.


DATA
ENTER
Press the DATA/ENTER Key to display the Jog Speed Table Save display.
StorE
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

■ Fn806: Program Table Initialization

This function initializes the program table, i.e., returns the program table settings to their factory default settings.


Fn806
DATA ENTER
Press the DATA/ENTER Key to display the Program Table Initialization display.
Init
DATA ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

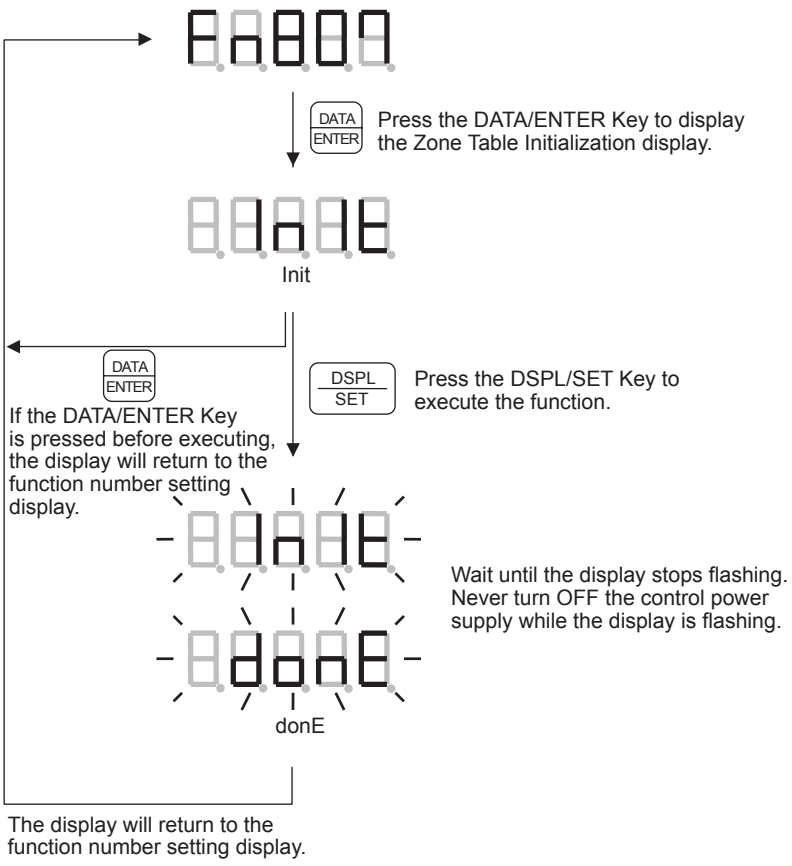
Related Errors

The following table shows the main errors related to program table initialization.

Error Display	Error Code and Name	Description
E5EE	E5EE: Execution Disabled during Program Operation Error	The program table cannot be initialized while program operation is in progress or on hold (interrupted). Reset program operation and try again.

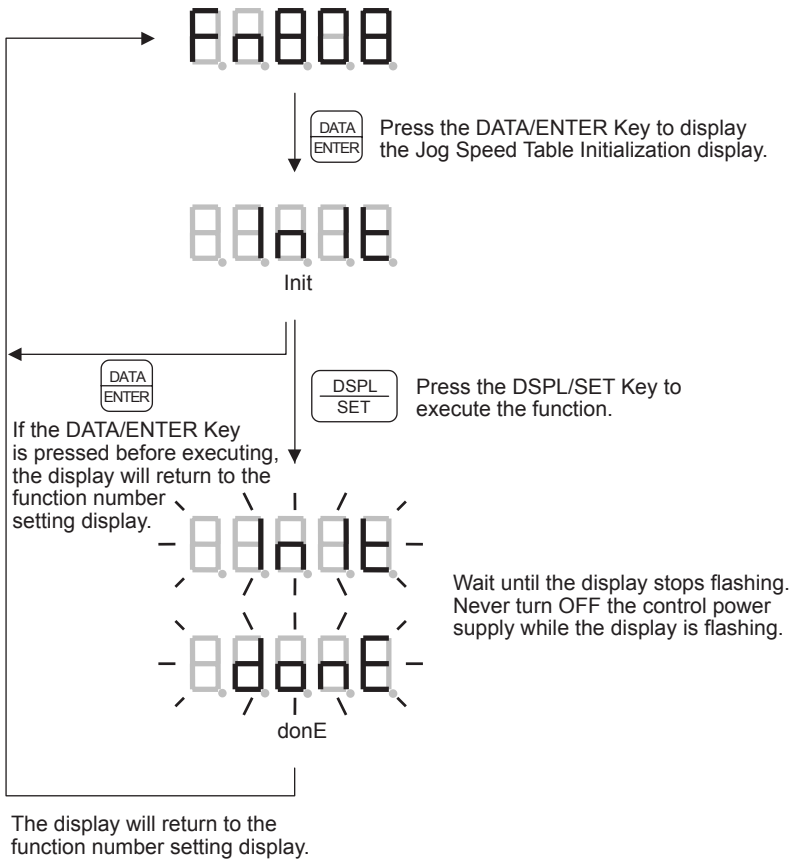
■ Fn807: Zone Table Initialization

This function initializes the zone table, i.e., returns the zone table settings to their factory default settings.


Fn807
DATA
ENTER
Press the DATA/ENTER Key to display the Zone Table Initialization display.
Init
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

■ Fn808: Jog Speed Table Initialization

This function initializes the jog speed table, i.e., returns the jog speed table settings to their factory default settings.


Fn808
DATA
ENTER
Press the DATA/ENTER Key to display the Jog Speed Table Initialization display.
Init
DATA
ENTER
If the DATA/ENTER Key is pressed before executing, the display will return to the function number setting display.
DSPL
SET
Press the DSPL/SET Key to execute the function.
Wait until the display stops flashing. Never turn OFF the control power supply while the display is flashing.
donE
The display will return to the function number setting display.

7.8 Operations during Program Table Editing Display

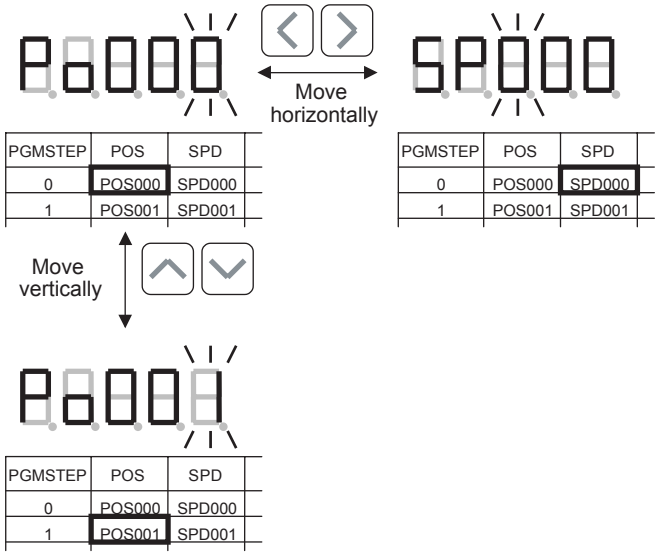
The program table can be edited during the program table editing display.

The following diagram shows the codes for each column of the program table.

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	POS000	SPD000	RDST000	RSPD000	POUT000	EVENT000	LOOP000	NEXT000
1	POS001	SPD001	RDST001	RSPD001	POUT001	EVENT001	LOOP001	NEXT001
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
127	POS127	SPD127	RDST127	RSPD127	POUT127	EVENT127	LOOP127	NEXT127

1. Use the Keys to move between columns and rows.

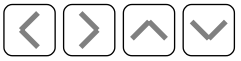
◀ EXAMPLE ▶



PGMSTEP	POS	SPD
0	POS000	SPD000
1	POS001	SPD001

2. Press the DATA/ENTER Key to display the setting editing display. Press the DATA/ENTER Key again to return to the initial program table display.

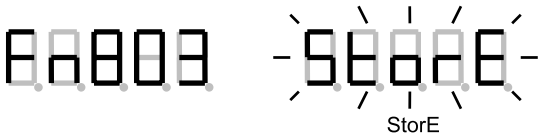
Example:

3. Edit the setting with the  Keys.

4. Press the DATA/ENTER Key to enter the new setting and return to the program table number display.

INFO

The Program Table Save function (Fn803) can be executed to save the new settings to flash memory. Once saved to flash memory, the data will be retained even if the control power supply goes OFF. See page 7-42 for details.



Related Errors

The following table shows the main errors related to the program table editing operations.

Error Display	Error Code and Name	Description
	E5EE: Execution Disabled during Program Operation Error	The program table cannot be edited while program operation is in progress or on hold (interrupted). Reset program operation and try again.

7

■ POS: Target Position

This parameter sets the target position.

Press the DATA/ENTER Key to display the Target Position Edit display.□
(Press the DATA/ENTER Key again to return to the program table number display.)

Example: "-"

-

Changing the Target Position Setting

-

Target position set to "-".

-InF I

Target position set to "-INFINITE".

+InFI

Target position set to "+INFINITE".

Example: Target position set to I +12,345,678.

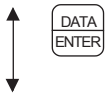
Example: Target position set to A+12,345,678.

StoP

Target position set to "STOP".

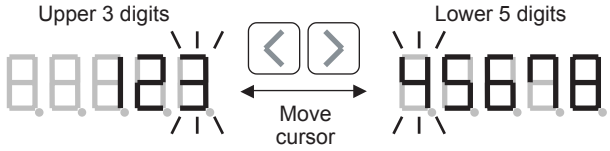
■ SPD: Positioning Speed

This parameter sets the positioning speed.



Press the DATA/ENTER Key to display the Positioning Speed Edit display. (Press the DATA/ENTER Key again to return to the program table number display.)

Example: "12,345,678"



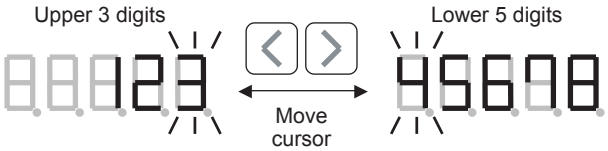
Use the Up and Down Keys to change the setting.

■ RDST: Registration Distance

This parameter sets the registration distance.

Press the DATA/ENTER Key to display the Registration Distance Edit display. (Press the DATA/ENTER Key again to return to the program table number display.)

Example: "12,345,678"

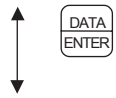


Use the Up and Down Keys to change the setting.

If the registration distance is set to a negative value, the setting will automatically be changed to "-".

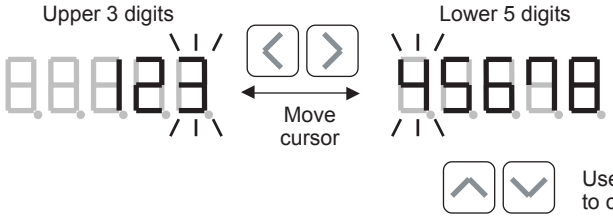
■ RSPD: Registration Speed

This parameter sets the registration speed.



Press the DATA/ENTER Key to display the Registration Speed Edit display. (Press the DATA/ENTER Key again to return to the program table number display.)

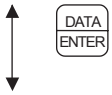
Example: "12,345,678"



Use the Up and Down Keys to change the setting.

■ POUT: Programmable Output Signals

This parameter sets the usage of the programmable output signals.



Press the DATA/ENTER Key to display the Editing display. (Press the DATA/ENTER Key again to return to the program table number display.)

Example: ": : : : :"

Use the Up and Down Keys to change the setting.

Changing the Programmable Output Signal Setting

Set to ":".

:

Set to "Z".

Z

Set to "A".

A

Set to "n".

n

■ EVENT: Pass Condition

This parameter sets the pass condition.

Press the DATA/ENTER Key to display the Editing display.
(Press the DATA/ENTER Key again to return to the program table number display.)

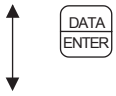
Example: ":"

:

Changing the EVENT Setting

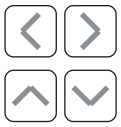
■ LOOP: Number of Executions

This parameter sets the number of executions (repetitions).



Press the DATA/ENTER Key to display the Editing display.
(Press the DATA/ENTER Key again to return to the program table number display.)

Example: "1"



Use the Left and Right Keys to move the cursor.

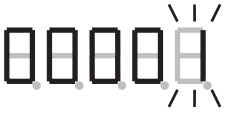
Use the Up and Down Keys to change the setting.

■ NEXT: PGMSTEP to be Executed Next

This parameter sets the PGMSTEP number that will be executed next.

Press the DATA/ENTER Key to display the Editing display.
(Press the DATA/ENTER Key again to return to the program table number display.)

Example: "1"



Use the Left and Right Keys to move the cursor.

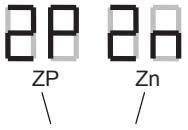
Use the Up and Down Keys to change the setting.

If the NEXT parameter is set to a negative value, the setting will automatically be changed to “End.”

7.9 Operation during Zone Table Editing Display

The zone table can be edited during the zone table editing diaplay.

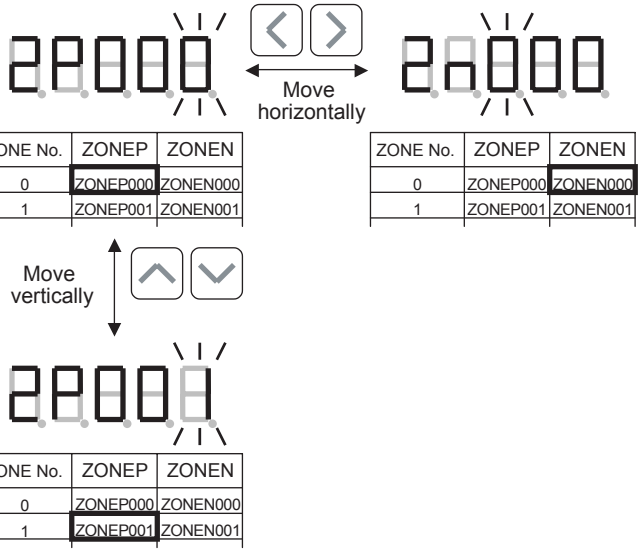
The following diagram shows the codes for each column of the zone table.



ZONE No.	ZONEP	ZONEN
0	ZONEP000	ZONEN000
1	ZONEP001	ZONEN001
. . .	. . .	. . .
31	ZONEP031	ZONEN031

1. Use the Keys to move between columns and rows.

◀ EXAMPLE ▶



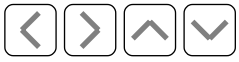
ZONE No.	ZONEP	ZONEN
0	ZONEP000	ZONEN000
1	ZONEP001	ZONEN001

ZONE No.	ZONEP	ZONEN
0	ZONEP000	ZONEN000
1	ZONEP001	ZONEN001

ZONE No.	ZONEP	ZONEN
0	ZONEP000	ZONEN000
1	ZONEP001	ZONEN001

2. Press the DATA ENTER Key to display the setting editing display. (Press the DATA/ENTER Key again to return to the initial zone table display.)

Example:

3. Edit the setting with the  Keys.

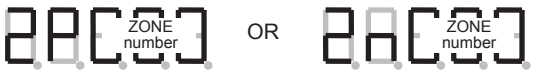
4. Press the DATA ENTER Key to enter the new setting and return to the zone table number display.

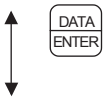
INFO

The Zone Table Save function (Fn804) can be executed to save the new settings to flash memory. Once saved to flash memory, the data will be retained even if the control power supply goes OFF. See page 7-43 for details.

■ ZONEP: Forward (Positive) Zone Setting, ZONEN: Reverse (Negative) Zone Setting

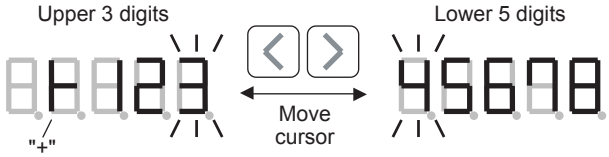
These parameters define the zones in the zone table.





Press the DATA/ENTER Key to display the Zone Setting Edit display.
(Press the DATA/ENTER Key again to return to the zone table number display.)

Example: "+12,345,678"



Use the Up and Down Keys to change the setting.

7.10 Operation during Jog Speed Table Editing Display

The jog speed table can be edited during the jog speed table editing diaplay.

The following diagram shows the code for the column of the jog speed table.

JS

JOG speed No.	JSPD
0	JSPD000
1	JSPD001
. . .	. . .
15	JSPD015

1. Use the ▽ △ Keys to move between rows.

◀ EXAMPLE ▶

JOG speed No.	JSPD
0	JSPD000
1	JSPD001

△ ▽ Move vertically

JOG speed No.	JSPD
0	JSPD000
1	JSPD001

2. Press the DATA ENTER Key to display the setting editing display. (Press the DATA/ENTER Key again to return to the initial jog speed table display.)

Example:

000

3. Edit the setting with the ◁ ▷ △ ▽ Keys.

4. Press the DATA ENTER Key to enter the new setting and return to the jog speed table number display.

7

INFO

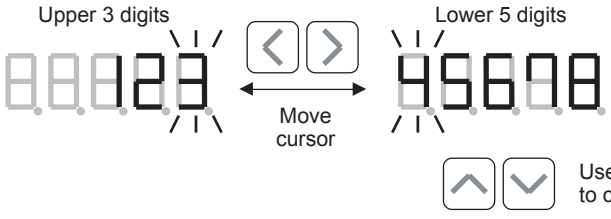
The Jog Speed Table Save function (Fn805) can be executed to save the new settings to flash memory. Once saved to flash memory, the data will be retained even if the control power supply goes OFF. See page 7-44 for details.

■ JSPD: Jog Speed Table

This parameter sets the jog speed.

Press the DATA/ENTER Key to display the Jog Speed Setting Edit display. (Press the DATA/ENTER Key again to return to the jog speed table number display.)

Example: "12,345,678"



Use the Up and Down Keys to change the setting.

8

Dimensions

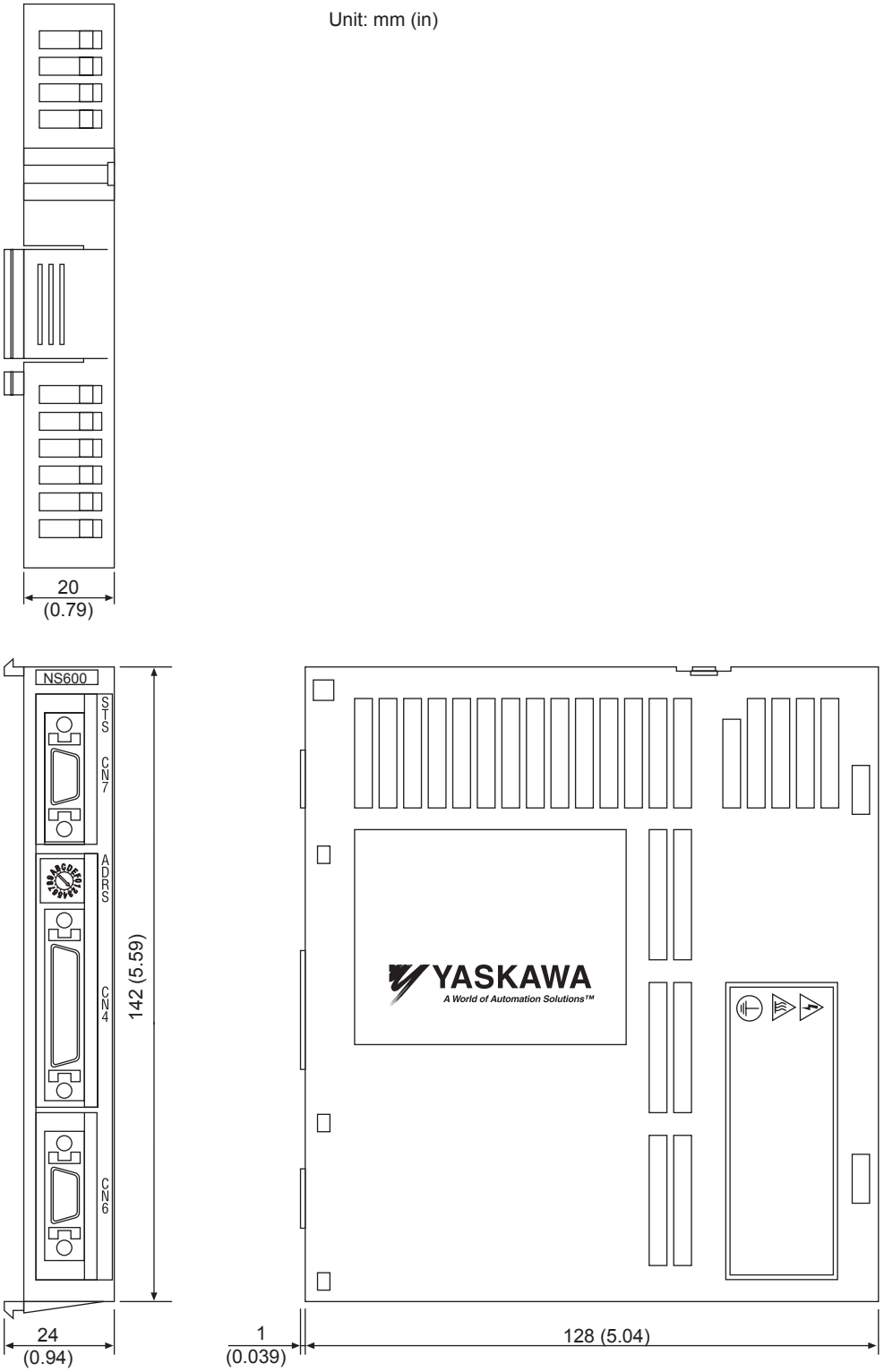
This chapter provides a dimensional drawing of the NS600.

8.1 NS600 Dimensions - 8-2

8.1 NS600 Dimensions

The following diagram shows the external dimensions of the NS600.

Unit: mm (in)



9

Troubleshooting

This chapter describes the troubleshooting procedures for problems which cause an alarm display, problems that do not cause an alarm display, and related functions.

9.1 Servodrive Troubleshooting ----------9-2
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9.1 Servodrive Troubleshooting

This section explains how to troubleshoot and correct servodrive problems.

9.1.1 Alarm Display Table

The following table shows the alarm displays and meaning of the alarms.

Table 9.1 Alarm Displays and Outputs

Alarm Display	Alarm Name	Meaning	ALM Output	Alarm Code Outputs		
				ALO1	ALO2	ALO3
A.02	Parameter Breakdown*2	EEPROM data of SERVOPACK is abnormal.	OFF	OFF	OFF	OFF
A.03	Main Circuit Encoder Error	Detection data for power circuit is abnormal.				
A.04	Parameter Setting Error*2	The parameter setting is outside the allowable setting range.				
A.05	Combination Error	SERVOPACK and servomotor capacities do not match each other.				
A.10	Overcurrent or Heat Sink Overheated*2	An overcurrent flowed through the IGBT. Heat sink of the SERVOPACK was overheated.	OFF	ON	OFF	OFF
A.30	Regeneration Error Detected	• Regenerative circuit is faulty. • Regenerative resistor is faulty.	OFF	ON	ON	OFF
A.32	Regenerative Overload	Regenerative energy exceeds regenerative resistor capacity.				
A.40	Overvoltage*3	Main circuit DC voltage is excessively high.	OFF	OFF	OFF	ON
A.41	Undervoltage*3	Main circuit DC voltage is excessively low.				
A.51	Overspeed	Rotational speed of the motor is excessively high.	OFF	ON	OFF	ON
A.71	Overload: High Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.	OFF	ON	ON	ON
A.72	Overload: Low Load	The motor was operating continuously under a torque largely exceeding ratings.				
A.73	Dynamic Brake Overload	When the dynamic brake was applied, rotational energy exceeded the capacity of dynamic brake resistor.				
A.74	Overload of Surge Current Limit Resistor	The main circuit power was frequently turned ON and OFF.				
A.7A	Heat Sink Overheated *1	The heat sink of SERVOPACK overheated.				

Table 9.1 Alarm Displays and Outputs (cont'd)

Alarm Display	Alarm Name	Meaning	ALM Output	Alarm Code Outputs		
				ALO1	ALO2	ALO3
A.81	Encoder Backup Error*2	All the power supplies for the absolute encoder have failed and position data was cleared.	OFF	OFF	OFF	OFF
A.82	Encoder Checksum Error*2	The checksum results of encoder memory is abnormal.				
A.83	Absolute Encoder Battery Error	Battery voltage for the absolute encoder has dropped.				
A.84	Encoder Data Error*2	Data in the encoder is abnormal.				
A.85	Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.	OFF	OFF	OFF	OFF
A.86	Encoder Overheated	The internal temperature of encoder is too high.				
A.b1	Reference Speed Input Read Error	The A/D converter for reference speed input is faulty.				
A.b2	Reference Torque Input Read Error	The A/D converter for reference torque input is faulty.				
A.bF	System Alarm*2	A system error occurred in the SERVOPACK.				
A.C1	Servo Overrun Detected	The servomotor ran out of control.	OFF	ON	OFF	ON
A.C8	Absolute Encoder Clear Error and Multiturn Limit Setting Error*2	The multiturn for the absolute encoder was not properly cleared or set.				
A.C9	Encoder Communications Error*2	Communications between SERVOPACK and encoder is not possible.				
A.CA	Encoder Parameter Error*2	Encoder parameters are faulty.				
A.Cb	Encoder Echoback Error*2	Contents of communications with encoder is incorrect.				
A.CC	Multiturn Limit Disagreement	Different multiturn limits have been set in the encoder and SERVOPACK.				
A.d0	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).	OFF	ON	ON	OFF
A.EF	Application Module Error	Some kind of alarm occurred in the Application Module. Check the NS600 Alarm Display.	OFF	OFF	ON	ON
A.F1	Power Line Open Phase	One phase is not connected in the main power supply.	OFF	OFF	ON	OFF
A.--	Not an error	Normal operating status	ON	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (high).
ON: Output transistor is ON (low).

* 1. This alarm display appears only within the range of 30 W to 1000 W.
* 2. These alarms cannot be reset with the alarm reset signal (/ALM-RST). Eliminate the cause of the alarm and then turn the control power supply OFF/ON or execute the RES command to reset the alarm.
* 3. For the SERVOPACK with a capacity of 6.0 kW or higher, alarm A.40 indicates main circuit DC voltage is excessively high or low.

9.1.2 Warning Display Table

The following table shows the warning displays, status of the alarm code outputs, and meaning of the warnings.

Table 9.2 Warning Displays and Outputs

Warning Display	Warning Name	Meaning	Warning Code Outputs		
			ALO1	ALO2	ALO3
A.91	Overload	This warning occurs before the overload alarms (A.71 or A.72) occur. If the warning is ignored and operation continues, an overload alarm may occur.	ON	OFF	OFF
A.92	Regenerative Overload	This warning occurs before the regenerative overload alarm (A.32) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may occur.	OFF	ON	OFF
A.93	Absolute Encoder Battery Warning	This warning indicates that the absolute encoder's battery voltage has dropped. If the warning is ignored and operation continues, an absolute encoder battery alarm may occur.	ON	ON	OFF
A.9F	NS600 Error	This warning indicates that some kind of error occurred in the NS600. Check the NS600 Error Display for details.	ON	ON	ON

Note: OFF: Output transistor is OFF (high).
ON: Output transistor is ON (low).

9.1.3 Troubleshooting Problems with No Alarm Display

Refer to the tables below to identify the cause of a problem that causes no alarm display and take the remedy described.

Turn OFF the servo system power supply before starting the shaded procedures.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

Table 9.3 Troubleshooting Table with No Alarm Display

Symptom	Cause	Inspection	Remedy
Servomotor Does Not Start	Power not connected	Check voltage between power supply terminals.	Correct the power circuit.
	Loose connection	Check terminals of connectors (CN1, CN2, CN4, and CN6).	Tighten any loose parts.
	Connector (CN1, CN4, or CN6) external wiring incorrect	Check connector (CN1, CN4, and CN6) external wiring.	Refer to connection diagram and correct wiring.
	Servomotor or encoder wiring disconnected.	---	Reconnect wiring
	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
	/S-ON is turned OFF.	---	Turn /S-ON input ON, execute the SVON command, or set parameter Pn80B=2 so that the servo is always ON.
	P-OT and N-OT inputs are turned OFF.	Refer to *5.2.2 Setting the Overtravel Limit Function* for details.	Turn P-OT and N-OT input signals ON.
	A software position reference limit (P-LS or N-LS) is ON.	Check for NS600 errors.	Check the motor position and the position reference limit settings (Pn81B and Pn81C). If necessary, move within the software position reference limits.
	There is no position reference or it is incorrect.	Check for NS600 errors.	Set the program table correctly.
Servomotor Moves Instantaneously, then Stops	Servomotor or encoder wiring incorrect.	---	Refer to *Chapter 3 Wiring* in the *Σ-II Series SGM□H/SGDH User's Manual Design and Maintenance* (Manual Number SIE-S800-32.2) and correct the wiring.
Servomotor Speed Unstable	Wiring connection to motor defective.	Check connection of power lead (phases-U, -V, and -W) and encoder connectors.	Tighten any loose terminals or connectors.
Servomotor Vibrates at Approximately 200 to 400 Hz.	Speed loop gain value too high.	---	Reduce speed loop gain (Pn100) preset value.

Table 9.3 Troubleshooting Table with No Alarm Display (cont'd)

Symptom	Cause	Inspection	Remedy
High Rotation Speed Overshoot on Starting and Stopping.	Speed loop gain value too high.	---	Reduce speed loop gain (Pn100) preset value. Increase integration time constant (Pn101).
	Speed loop gain is too low compared to position loop gain.	---	Increase the value of parameter Pn100 (speed loop gain). Reduce the integration time constant (Pn101).
Servomotor Overheated	Ambient temperature too high	Measure servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
	Servomotor surface dirty	Visual check	Clean dust and oil from motor surface.
	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
Abnormal Noise	Mechanical mounting incorrect	Servomotor mounting screws loose?	Tighten mounting screws.
		Coupling not centered?	Center coupling.
		Coupling unbalanced?	Balance coupling.
	Bearing defective	Check noise and vibration near bearing.	Consult your Yaskawa representative if defective.
	Machine causing vibrations	Foreign object intrusion, damage or deformation of sliding parts of machine.	Consult with machine manufacturer.

9.2 NS600 Troubleshooting

This section explains how to troubleshoot and correct NS600 problems.

9.2.1 Status Displays

Displays when an Alarm Occurred

Serious errors that occur unexpectedly are known as alarms.

When an alarm occurs, the servo will be forced OFF.

Display or Signal	Content
STS Status Indicator	Green LED: Continuously OFF Red LED: Continuously Lit
Digital Operator (connected to CN7)	In Status Display Mode, the alarm code is displayed continuously. In other Modes, the alarm code is displayed for just 2 seconds.
Response to the Alarm or Warning Read command (ALM)	Alarm code
Response to the Most Recent Error Read command (ERR)	No change
Panel	Displays A.EF or the SERVOPACK alarm code. In some cases, nothing is displayed.
ALM signal	Active (photocoupler OFF)
/WARN signal	No change

Displays when an Error Occurred

Negative acknowledgments (error responses) to input signals, serial commands, or operations from the Digital Operator are known as errors.

The error status lasts only for the moment that the error occurred, but the display and signal output will remain for 2 seconds.

The servo will not be turned OFF when an error occurs.

Display or Signal	Content
STS Status Indicator	The Red LED flashes for just 2 seconds.
Digital Operator (connected to CN7)	The error code is displayed for just 2 seconds.
Response to the Alarm or Warning Read command (ALM)	No change
Response to the Most Recent Error Read command (ERR)	Error code (the most recent error code)
Panel	Displays A.9F for just 2 seconds. In some cases, nothing is displayed.
ALM signal	No change
/WARN signal	Active for just 2 seconds

Displays when a Warning Occurred

Minor errors that occur unexpectedly are known as warnings.

The servo will not be turned OFF when a warning occurs.

Display or Signal	Content
STS Status Indicator	The Red LED flashes continuously.
Digital Operator (connected to CN7)	In Status Display Mode, the warning code is displayed continuously. In other Modes, the warning code is displayed for just 2 seconds.
Response to the Alarm or Warning Read command (ALM)	Warning code
Response to the Most Recent Error Read command (ERR)	No change
Panel	Displays the SERVOPACK warning code. In some cases, nothing is displayed.
ALM signal	No change
/WARN signal	Active

Normal Displays

The displays and signals are normal when no alarms, errors, or warnings have occurred.

Display or Signal	Content
STS Status Indicator	Green LED: Continuously Lit Red LED: Continuously OFF
Digital Operator (connected to CN7)	In Status Display Mode, the display shows the status such as POT, BB, or RUN.
Response to the Alarm or Warning Read command (ALM)	Returns BB, COIN, HOLD, P-OT, etc.
Response to the Most Recent Error Read command (ERR)	Error code (the most recent error code)
Panel	Displays BB or RUN. In some cases, nothing is displayed.
ALM signal	Inactive (photocoupler ON)
/WARN signal	Inactive

9.2.2 Alarm Display Table

Refer to the following table to identify the cause of a problem and take the remedy described.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

Table 9.4 NS600 Alarm Displays

Alarm Display*1	Alarm Name	Details	Remedy	Panel Display*2	Alarm Reset
A.□□	SGDH Alarm Activation Alarm	A SERVOPACK alarm occurred.	See *9.1.1 Alarm Display Table* for details. (□□ = SERVOPACK alarm code)	A.□□	See 9.1.1
CPF00	System Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware is not recorded properly.	Repair the firmware.	A.E0	Ineffective
		Memory device verification failed.	Repair the memory device.		
		The Digital Operator is faulty.	Replace the Digital Operator.		
E12A	Firmware Execution Alarm	The firmware processing time was too long.	• Upgrade the firmware version. • Reduce the number of functions being used.	A.EF	Ineffective
E13A	Firmware Version Unmatched (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware and hardware are not compatible.	Replace the firmware or the hardware.	A.EF	Ineffective
E14A	Parameter Checksum Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	Incorrect or corrupted parameters are stored in EEPROM. (This alarm can occur if the control power supply is turned OFF while the parameters are being initialized or changed.)	• Initialize the parameters with the PRMINIT command or Fn005 function. • If the problem is not solved, correct the parameters.	A.EF	Ineffective
E15A	Parameter Version Unmatched (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware version is not compatible with the version of the parameters.	Replace the firmware or parameters.	A.EF	Ineffective
E16A	Parameter Out-of-range Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	The moving method is set to a rotary method (Pn81A = 1, 2, or 3), but the home position set in Pn81D exceeds the software position reference limits set in Pn81B and Pn81C.	Correct the home position setting (Pn81D) or the software position reference limits (Pn81B and Pn81C).	A.EF	Ineffective

Table 9.4 NS600 Alarm Displays (cont'd)

Alarm Display*1	Alarm Name	Details	Remedy	Panel Display*2	Alarm Reset
E17A	Initial Communication Alarm between NS600 and SGDH (Detected only when control power supply is turned ON or the RES command is executed.)	When the control power supply was turned ON or the RES command was executed, the NS600 was unable to acquire necessary information from the SERVOPACK, such as parameters or an absolute encoder's position data. (When an absolute encoder is being used, this alarm can occur if the Digital Operator is connected to SERVOPACK connector CN3 and the position data cannot be acquired.)	• Connect the Digital Operator to CN7. • Take steps to reduce noise in the system such as improving the frame ground.	A.E0	Ineffective
E18A	Communication Alarm between NS600 and SGDH (after initialization)	An error occurred in communications between the NS600 and SGDH during operation.	Take steps to reduce noise in the system such as improving the frame ground.	A.E2	Effective
E19A	Program Table Checksum Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	The program table stored in flash memory was not recorded properly. (This alarm can occur if the control power supply is turned OFF while the program table is being saved or initialized.)	• Initialize the program table with the PGMINIT command or Fn806 function. • If the problem is not solved, correct the program table.	A.EF	Effective*3
E1AA	Program Version Unmatched (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware version is not compatible with the program table version being used.	Replace the firmware or program table.	A.EF	Effective*3
E1BA	Program Out-of-range Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	A value set in the program table is not within the allowed setting range.	Replace the firmware or program table.	A.EF	Effective*3
E1CA	Zone Table Checksum Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	The zone table stored in flash memory was not recorded properly. (This alarm can occur if the control power supply is turned OFF while the zone table is being saved or initialized.)	• Initialize the zone table with the ZONEINIT command or Fn807 function. • If the problem is not solved, correct the zone table.	A.EF	Effective*4

Table 9.4 NS600 Alarm Displays (cont'd)

Alarm Display[*1]	Alarm Name	Details	Remedy	Panel Display[*2]	Alarm Reset
E1DA	Zone Table Version Unmatched (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware version is not compatible with the zone table version being used.	Replace the firmware or zone table.	A.EF	Effective[*4]
E1EA	Zone Table Out-of-range Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	A value set in the zone table is not within the allowed setting range.	Replace the firmware or zone table.	A.EF	Effective[*4]
E1FA	Jog Speed Table Checksum Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	The jog speed table stored in flash memory was not recorded properly. (This alarm can occur if the control power supply is turned OFF while the jog speed table is being saved or initialized.)	• Initialize the jog speed table with the JSPDINIT command or Fn808 function. • If the problem is not solved, correct the jog speed table.	A.EF	Effective[*5]
E21A	Jog Speed Table Version Unmatched (Detected only when control power supply is turned ON or the RES command is executed.)	The firmware version is not compatible with the jog speed table version being used.	Replace the firmware or jog speed table.	A.EF	Effective[*5]
E22A	Jog Speed Table Out-of-range Alarm (Detected only when control power supply is turned ON or the RES command is executed.)	A value set in the jog speed table is not within the allowed setting range.	Replace the firmware or jog speed table.	A.EF	Effective[*5]
E23A	Insufficient Registration Distance Alarm	The registration distance was shorter than the deceleration distance when the /RGRT signal went ON to start registration operation. (The registration distance will be exceeded even if deceleration begins immediately.)	Either increase the registration distance or reduce the deceleration distance (increase the deceleration rate). The registration distance can be set by executing the RDST command or changing the RDST parameter in the program table. The deceleration rate can be changed by executing the DEC command or changing parameter Pn820.	A.EF	Effective

* 1. This is the alarm code displayed on the Digital Operator when it is connected to CN7. This same alarm code is also used in the response to the ALM command.

* 2. The panel display may be OFF depending on communications between the NS600 and the SERVOPACK.

* 3. These alarms can be reset, but a Program Table Checksum Error (E44E) will occur the next time you attempt to start program table operation, so program table operation will not be possible.

* 4. These alarms can be reset, but it is possible that the zone signals (POUT0 to POUT4) will be output incorrectly. When using the zone table, correct the alarm without resetting.
* 5. These alarms can be reset, but a Jog Speed Table Checksum Error (E46E) will occur the next time you attempt to start jog speed table operation, so jog speed table operation will not be possible.

9.2.3 Error Display Table

Refer to the following table to identify the cause of a problem and take the remedy described.

Table 9.5 NS600 Error Displays

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E41E	Program Table Save Failure Error	The flash memory write process failed during a program table save operation (execution of the PGMSTORE command or Fn803) or program table initialization operation (execution of the PGMINIT command or Fn806).	Repair the hardware.	A.9F
E42E	Zone Table Save Failure Error	The flash memory write process failed during a zone table save operation (execution of the ZONESTORE command or Fn804) or zone table initialization operation (execution of the ZONEINIT command or Fn807).	Repair the hardware.	A.9F
E43E	Jog Speed Table Save Failure Error	The flash memory write process failed during a jog speed table save operation (execution of the JSPDSTORE command or Fn805) or jog speed table initialization operation (execution of the JSPDINIT command or Fn808).	Repair the hardware.	A.9F
E44E	Program Table Checksum Error	There was a request to start program table operation even though an E19A, E1AA, or E1BA alarm occurred when the control power supply was turned ON or the RES command was executed.	When program table operation is being used, the cause of the alarm must be eliminated.	A.9F
E46E	Jog Speed Table Checksum Error	There was a request to start jog speed table operation even though an E1FA, E20A, or E21A alarm occurred when the control power supply was turned ON or the RES command was executed.	When jog speed table operation is being used, the cause of the alarm must be eliminated.	A.9F
E47E	Serial Communications Receiving Buffer Overflow Error	There was an overflow in the reception buffer used for serial commands. • An error will occur if too many serial commands are sent consecutively without waiting for the responses. (Normally, the reception buffer will not overflow if there is command/response handshaking.) • When an overflow has occurred, error code E47E will be returned and all of the data that has accumulated in the reception buffer will be discarded.	Wait for a response to be received before sending the next command. The reception buffer can contain up to 100 commands.	A.9F

Table 9.5 NS600 Error Displays (cont'd)

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E48E	Serial Communications Parity Error	A parity check error occurred with the serial command. • This error will occur if even parity is not being used. • The command that caused this error will be discarded and no response will be returned. • There will be no response, but the /WARN output and LED indicators will indicate that an error has occurred.	• Check the serial communications protocol (Pn800) and baud rate (Pn801) settings. • Check the wiring. • If noise may be causing the problem, take steps to reduce noise such as using communications cables with ferrite cores.	A.9F
E49E	Serial Communications Framing Error	A stop bit detection error occurred with the serial command. • The command that caused this error will be discarded and no response will be returned. • There will be no response, but the /WARN output and LED indicators will indicate that an error has occurred.	• Check the serial communications protocol (Pn800) and baud rate (Pn801) settings. • Check the wiring. • If noise may be causing the problem, take steps to reduce noise such as using communications cables with ferrite cores.	A.9F
E4AE	Serial Communications Overrun Error	Serial command reception failed. • The hardware's reception buffer was overwritten with the subsequent data. (Normally, data is read before it is overwritten, so this error does not occur.)	Repair the hardware.	A.9F
E4BE	Moving Disabled Error due to P-OT	Travel in the forward direction was requested when P-OT was in effect. (Forward movement is disabled when P-OT (positive overtravel) is in effect.)	• When P-OT is being used, move to a position where the P-OT is not in effect. • When P-OT is not being used, disable P-OT in the parameter (Pn80C = 3).	A.9F
E4CE	Moving Disabled Error due to N-OT	Travel in the reverse direction was requested when N-OT was in effect. (Reverse movement is disabled when N-OT (negative overtravel) is in effect.)	• When N-OT is being used, move to a position where the N-OT is not in effect. • When N-OT is not being used, disable N-OT in the parameter (Pn80D = 3).	A.9F
E4DE	Moving Disabled Error due to P-LS	The specified target position exceeds the position reference forward limit set in Pn81B.	• Check the target position specification. • Check the forward limit in Pn81B. • Check the moving method (rotary or linear) set in Pn81A. • If software position limits are not being used, either select a rotary moving method in Pn81A or disable the limits by setting Pn81B = Pn81C = 0.	A.9F

Table 9.5 NS600 Error Displays (cont'd)

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E4EE	Moving Disabled Error due to N-LS	The specified target position exceeds the position reference reverse limit set in Pn81C.	• Check the target position specification. • Check the reverse limit in Pn81C. • Check the moving method (rotary or linear) set in Pn81A. • If software position limits are not being used, either select a rotary moving method in Pn81A or disable the limits by setting Pn81B = Pn81C = 0.	A.9F
E4FE	Position Reference Out-of-range Error	The moving method is set to rotary (Pn81A = 1, 2, or 3) and the target position specification exceeds the position reference limits in Pn81B and Pn81C.	• Check the target position specification. • Check the positioning range set with Pn81B and Pn81C. • Check the moving method (rotary or linear) set in Pn81A.	A.9F
E51E	Target Position Unspecified Error	Even though the target position wasn't specified even once, there was a request by the ST command to start positioning or a request by the RS command to start registration positioning.	Specify a target position with a command such as the POS command, STnnnnnnnn command, or RSnnnnnnnn command.	A.9F
E52E	Registration Distance Unspecified Error	Even though the registration distance wasn't specified even once, there was a request by the RS command to start registration positioning.	Specify a registration distance with the RDST command.	A.9F
E53E	Move Reference Duplication Error	There was a new move reference requested even though the system was already moving in a positioning operation or other travelling operation.	• Send the next move reference request only after the current movement operation is completed (Position reference distribution is completed). • A movement operation can be interrupted or cancelled with the HOLD or SKIP serial commands. Also, STOP can be specified in the target position reservation (POS) with the program table.	A.9F

Table 9.5 NS600 Error Displays (cont'd)

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E54E	Servo ON Incomplete Error	The servo is not ON. • There was a positioning request or other move reference request in servo OFF status.	Send the move reference request only after turning the servo ON by turning ON the /S-ON signal, setting Pn80B = 2 so that the servo is always ON, or executing the SVON command.	A.9F
		The servo went OFF during program table operation. (Program table operation will be interrupted when just the step that was being executed is cancelled (LOOP ≠ 1 and first LOOP.))	There are two possibilities. • The program can be cancelled with the /PGMRES signal or PGMRES command. • The servo can be turned ON and the program can be restarted with the /START-STOP signal or the START command.	A.9F
E55E	Servo ON Failure Error	The servo could not be turned ON within 2 s after turning ON the /S-ON signal or executing the SVON command. • The motor is rotating during servo ON execution. • The main power supply went OFF during servo ON execution. Error E5BE will occur if there was an alarm when the servo ON request was sent. Error E5CE will occur if the main power supply was OFF when the servo ON request was sent.	• Turn the servo ON when the motor is stopped. • Check the main power supply.	A.9F
E56E	Undefined Serial Command Error	• There was a syntax error in the serial command. • There was a number in the serial command longer than 8 digits.	• Check the serial command's character string. • Use the Digital Operator's Serial Command Reception Character Trace function (Un80D) to check the character string that the NS600 received.	A.9F
E57E	Address Out-of-range Error	The specified address was incorrect for a parameter, program table, zone table, jog speed table, or alarm history in a monitor read/write command.	• Check the address. • Use the Digital Operator's Serial Command Reception Character Trace function (Un80D) to check the character string that the NS600 received.	A.9F
E58E	Data Out-of-range Error	The specified setting was incorrect in a parameter or program table write command.	• Check the setting. • Use the Digital Operator's Serial Command Reception Character Trace function (Un80D) to check the character string that the NS600 received.	A.9F

Table 9.5 NS600 Error Displays (cont'd)

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E59E	Communication Failure Error between NS600 and SGDH	Communications between the NS600 and SERVOPACK failed when a Digital Operator or computer was connected to SERVOPACK connector CN3 and the SERVOPACK's parameter or monitor read/write command was sent.	Connect the Digital Operator or computer to NS600 connector CN7.	A.9F
E5AE	Execution Disabled while Servo ON Error	An auxiliary function such as Digital Operator jog operation or parameter initialization was requested when the servo was ON. (For safety, these functions cannot be executed with the servo ON.) Disabled Auxiliary Functions: Digital Operator jog operation, home position search, parameter initialization, absolute encoder reset, motor current automatic zero adjustment, precision (off-line) autotuning	Execute after turning the servo OFF.	A.9F
E5BE	Execution Disabled while Alarm Activated Error	Servo ON was requested (the /S-ON signal was turned ON or SVON command was executed) while there was an alarm.	Turn the servo ON after eliminating the cause of the alarm and clearing the alarm.	A.9F
E5CE	Execution Disabled while Main Power OFF Error	Servo ON was requested (the /S-ON signal was turned ON or SVON command was executed) while the main power supply was OFF.	Turn the servo ON after turning ON the main power supply.	A.9F
E5DE	Homing Method Unspecified Error	The homing method is not specified. • Homing Start was requested (/HOME signal was turned ON or ZRN command was executed) without setting the homing method.	Specify the homing method in Pn823.	A.9F
E5EE	Execution Disabled during Program Operation Error	• There was a request to execute a process that is not allowed during program table operation while program table operation was in progress or on hold. • There was an attempt to change the program table while program table operation was in progress or on hold. • There was a request to start positioning by a serial command while program table operation was in progress or on hold.	Request execution of the process again after cancelling program table operation with the /PGMRES signal or RES command.	A.9F
E5FE	Session Conflict Error	There was a request that could not be executed at the same time as the function that was being executed. Example: There was a request to start program table operation while the program table was being initialized.	Execute the operation again after the execution of the current function is completed.	A.9F

Table 9.5 NS600 Error Displays (cont'd)

Error Display*1	Error Name	Details	Remedy	Panel Display*2
E61E	Encoder Mismatch Error	There was a request that was incompatible with the connected encoder. Examples: • An Absolute Encoder Reset (ABSPGRES command or Fn008) was requested when an incremental encoder is connected. • Homing Start was requested (/HOME signal was turned ON or ZRN command was executed) when an absolute encoder is connected. (An absolute encoder can be used as an incremental encoder if parameter Pn002.2 = 1.)	Check the encoder.	A.9F
E62E	No A.CC Alarm Occurred Error	A Multiturn Limit Setting (MLTLTMSET command or Fn013) was requested even though alarm A.CC has not occurred. (Alarm A.CC indicates that Pn205 does not match the setting in the encoder after the multiturn limit setting in Pn205 was changed and the control power supply was turned OFF and ON.)	Use the Multiturn Limit Setting operation to adjust the setting in the encoder to match Pn205 only after alarm A.CC has occurred.	A.9F

* 1. This is the error code displayed on the Digital Operator when it is connected to CN7. This same code is also used in the response to the ERR command and error responses.
* 2. The panel display may be OFF depending on communications between the NS600 and the SERVOPACK.

9.2.4 Warning Display Table

Refer to the following table to identify the cause of a problem and take the remedy described.

Warning Display*1	Error Name	Details	Remedy	Panel Display*2
A.9□	SGDH SERVOPACK Warning	A SERVOPACK warning occurred.	See *9.1.2 Warning Display Table* for details. (The "9□" is the SERVOPACK's warning code.)	A.9□

* 1. This is the warning code displayed on the Digital Operator when it is connected to CN7. This same code is also used in the response to the ALM command.
* 2. The panel display may be OFF depending on communications between the NS600 and the SERVOPACK.

9.2.5 Normal Display Table

The following table shows the NS600's normal status displays.

Table 9.6 NS600 Normal Displays

Digital Operator Display	Name	Description	Panel Display*
POT	Forward (Positive) Over-travel (P-OT)	The P-OT signal is the input signal for the forward hardware limit switch. This display indicates that the P-OT signal is OFF. When the P-OT signal is being used, move to a position where the P-OT signal is ON. When the P-OT signal is not being used, disable the signal by setting Pn80C = 3.	BB or RUN
NOT	Reverse (Negative) Over-travel (N-OT)	The N-OT signal is the input signal for the reverse hardware limit switch. This display indicates that the N-OT signal is OFF. When the N-OT signal is being used, move to a position where the N-OT signal is ON. When the N-OT signal is not being used, disable the signal by setting Pn80D = 3.	BB or RUN
PLS	Forward (Positive) Position Reference Limit (P-LS)	This display indicates that the motor position exceeds the forward position reference limit setting (a software setting). When the Moving Method is set to Linear (Pn81A = 0), the forward position reference limit is set in Pn81B. When the forward position reference limit is being used, move to a position within the position reference limits. When the position reference limits are not being used because the system is a rotary system, set the moving method to Rotary by setting Pn81A = 1, 2, or 3. When the system is a linear system but position reference limits are not being used, disable the software limits by setting Pn81B = Pn81C = 0.	BB or RUN
NLS	Reverse (Negative) Position Reference Limit (N-LS)	This display indicates that the motor position exceeds the reverse position reference limit setting (a software setting). When the Moving Method is set to Linear (Pn81A = 0), the reverse position reference limit is set in Pn81C. When the reverse position reference limit is being used, move to a position within the position reference limits. When the position reference limits are not being used because the system is a rotary system, set the moving method to Rotary by setting Pn81A = 1, 2, or 3. When the system is a linear system but position reference limits are not being used, disable the software limits by setting Pn81B = Pn81C = 0.	BB or RUN
BB	Servo OFF (Baseblock)	This display indicates that power is not being supplied to the motor.	BB
RUN	Servo ON	This display indicates that power is being supplied to the motor.	RUN

* The panel display may be OFF depending on communications between the NS600 and the SERVOPACK.

9.3 STS Status Indicators

The following table shows the meaning of the STS Status Indicators (LED indicators).

Status	Green LED	Red LED
Control Power Supply OFF	Not lit	Not lit
Control Power Supply ON	Flashing	Not lit
Normal	Lit	Not lit
Overtravel/Software Limit Activated		
Resetting	Flashing	---
Saving a Table		
Initializing a Table		
Initializing Parameters		
Error	---	Flashing (2 seconds)
Warning	---	Flashing
Alarm	Not lit	Lit

Appendix A

List of Parameters

This appendix lists the parameters and switches for the NS600 and SGDH SERVOPACKs with an NS600 installed.

A.1 NS600 Parameters - A-2
A.2 SERVOPACK Parameters - A-6
A.3 SERVOPACK Switches - A-10

A.1 NS600 Parameters

The following table shows the NS600's parameters.

Table A.1 NS600 Parameters

Parameter	Name	Unit	Setting Range	Factory Setting
Pn800	Serial Communication Protocol*1	---	0: Full-duplex wiring 1: Full-duplex wiring, Echoback each character 2: Half-duplex wiring, delimiter CR 3: Half-duplex wiring, delimiter CR, Echoback each character 4: Half-duplex wiring, delimiter CR, Echoback each command 5: Half-duplex wiring, delimiter CR LF 6: Half-duplex wiring, delimiter CR LF, Echoback each character 7: Half-duplex wiring, delimiter CR LF, Echoback each command	1
Pn801	Baud rate*1	bps	0: 9,600 1: 19,200 2: 38,400	0
Pn802	Response "OK"*2	---	0: Disables response "OK." 1: Enables response "OK."	1
Pn803	/MODE 0/1*1	---	0: Closed = Mode 0 1: Closed = Mode 1 2: Always Mode 0 3: Always Mode 1	0
Pn804	/START-STOP; /HOME*1	---	0: Closed = Program Start (Mode 0) Homing Start (Mode 1) 1: Open = Program Start (Mode 0) Homing Start (Mode 1) 2 or 3: No Program Start (Mode 0) No Homing Start (Mode 1)	0
Pn805	/PGMRES; /JOGP*1	---	0: Open-to-closed: Reset program (Mode 0) Jog forward (Mode 1) 1: Closed-to-open: Reset program (Mode 0) Jog forward (Mode 1) 2 or 3: No program reset (Mode 0) No jog forward (Mode 1)	0
Pn806	/SEL0; /JOGN*1	---	0: Closed = Program select (Mode 0) Jog reverse (Mode 1) 1: Open = Program select (Mode 0) Jog reverse (Mode 1) 2: Always program select (Mode 0) No jog reverse (Mode 1) 3: No program select (Mode 0) No jog reverse (Mode 1)	0

Table A.1 NS600 Parameters (cont'd)

Parameter	Name	Unit	Setting Range	Factory Setting
Pn807	/SEL1; /JOG0*1	---	0: Closed = Program select (Mode 0) Jog select (Mode 1) 1: Open = Program select (Mode 0) Jog select (Mode 1) 2: Always program select (Mode 0) Always jog select (Mode 1) 3: No program select (Mode 0) No jog select (Mode 1)	0
Pn808	/SEL2; /JOG1*1	---	0: Closed = Program select (Mode 0) Jog select (Mode 1) 1: Open = Program select (Mode 0) Jog select (Mode 1) 2: Always program select (Mode 0) Always jog select (Mode 1) 3: No program select (Mode 0) No jog select (Mode 1)	0
Pn809	/SEL3; /JOG2*1	---	0: Closed = Program select (Mode 0) Jog select (Mode 1) 1: Open = Program select (Mode 0) Jog select (Mode 1) 2: Always program select (Mode 0) Always jog select (Mode 1) 3: No program select (Mode 0) No jog select (Mode 1)	0
Pn80A	/SEL4; /JOG3*1	---	0: Closed = Program select (Mode 0) Jog select (Mode 1) 1: Open = Program select (Mode 0) Jog select (Mode 1) 2: Always program select (Mode 0) Always jog select (Mode 1) 3: No program select (Mode 0) No jog select (Mode 1)	0
Pn80B	/S-ON*1	---	0: Closed = Servo ON 1: Open = Servo ON 2: Always Servo ON 3: Always Servo OFF	0
Pn80C	P-OT*1	---	0: Open = Positive (forward) overtravel 1: Closed = Positive (forward) overtravel 2: Always positive (forward) overtravel 3: Always movable	0
Pn80D	N-OT*1	---	0: Open = Negative (reverse) overtravel 1: Closed = Negative (reverse) overtravel 2: Always negative (reverse) overtravel 3: Always movable	0
Pn80E	/DEC*1	---	0: Open = Homing Deceleration LS ON 1: Closed = Homing Deceleration LS ON 2: Homing Deceleration LS Always ON 3: Homing Deceleration LS Always OFF	0
Pn80F	/RGRT*1	---	0: Closed = Registration Start 1: Open = Registration Start	0

Table A.1 NS600 Parameters (cont'd)

Parameter	Name	Unit	Setting Range	Factory Setting
Pn810	/INPOSITION*1	---	0: Closed = Positioning complete 1: Open = Positioning complete	0
Pn811	/POUT0*1	---	0: Closed = Active 1: Open = Active	0
Pn812	/POUT1*1	---	0: Closed = Active 1: Open = Active	0
Pn813	/POUT2*1	---	0: Closed = Active 1: Open = Active	0
Pn814	/POUT3*1	---	0: Closed = Active 1: Open = Active	0
Pn815	/POUT4*1	---	0: Closed = Active 1: Open = Active	0
Pn816	/WARN*1	---	0: Closed = Error/Warning status 1: Open = Error/Warning status	0
Pn817	/BK*1	---	0: Closed = Brake release 1: Open = Brake release	0
Pn818	/S-RDY*1	---	0: Closed = Servo ready 1: Open = Servo ready	0
Pn819	Overtravel (OT) Stop Method*1	---	0: Servo OFF (same as Pn001.0 setting) 1: Emergency stop 2: Deceleration stop	0
Pn81A	Moving Method*1	---	0: Linear 1: Rotary (shortest path) 2: Rotary (forward) 3: Rotary (reverse)	0
Pn81B	P-LS Position Reference Forward Limit*1	Reference units	–99,999,999 to +99,999,999	+99,999,999
Pn81C	N-LS Position Reference Reverse Limit*1	Reference units	–99,999,999 to +99,999,999	–99,999,999
Pn81D	Home Position*1	Reference units	–99,999,999 to +99,999,999	0
Pn81E	Positioning/Registration Speed*1	×1,000 reference units/min	1 to 99,999,999	1,000
Pn81F	Acceleration*2	×1,000 reference units/min/ms	1 to 99,999,999	1,000
Pn820	Deceleration*2	×1,000 reference units/min/ms	1 to 99,999,999	1,000
Pn821	/INPOSITION Width*2	Reference units	1 to 99,999	1
Pn822	Near Width*2	Reference units	1 to 99,999	1

Table A.1 NS600 Parameters (cont'd)

Parameter	Name	Unit	Setting Range	Factory Setting
Pn823	Homing Method*2	---	0: No Homing 1: /DEC and phase C 2: /DEC only 3: Phase C only	0
Pn824	Homing Direction*2	---	0: Forward 1: Reverse	0
Pn825	Homing Moving Speed*2	×1,000 reference units/min	1 to 99,999,999	1,000
Pn826	Homing Approach Speed*2	×1,000 reference units/min	1 to 99,999,999	1,000
Pn827	Homing Creep Speed*2	×1,000 reference units/min	1 to 99,999,999	1,000
Pn828	Homing Final Move Distance*2	Reference units	–99,999,999 to +99,999,999	0

* 1. These are off-line parameters. Turn OFF the power after changing these parameters. The new settings will become effective the next time that the power is turned ON or the RES serial command is executed.

* 2. These are on-line parameters. The new settings become effective immediately.

A.2 SERVOPACK Parameters

The following table shows the SERVOPACK's parameters.

Table A.2 SERVOPACK Parameters

Category	Parameter	Name	Unit	Setting Range	Factory Setting
Function Selection Constants	Pn000	Function Selection Basic Switches *3	---	---	0010
	Pn001	Function Selection Application Switches 1 *3	---	---	0000
	Pn002	Function Selection Application Switches 2 *3	---	---	0000
	Pn003	Function Selection Application Switches 3	---	---	0002
	Pn004	Fixed parameters (Do not change.)	---	---	---
	Pn005		---	---	---
Gain Related Constants	Pn100	Speed Loop Gain	Hz	1 to 2,000	40
	Pn101	Speed Loop Integral Time Constant	0.01 ms	15 to 51,200	2,000
	Pn102	Position Loop Gain	1/s	1 to 2,000	40
	Pn103	Inertia Ratio	%	0 to 10,000	0
	Pn104	Not used.	---	---	---
	Pn105	Not used.	---	---	---
	Pn106	Not used.	---	---	---
	Pn107	Bias	min^{-1}	0 to 450	0
	Pn108	Bias Width Addition	Reference units	0 to 250	7
	Pn109	Feed-forward	%	0 to 100	0
	Pn10A	Feed-forward Filter Time Constant	0.01 ms	0 to 6,400	0
	Pn10B	Gain-related Application Switches *3	---	---	0000
	Pn10C	Mode Switch Torque Reference	%	0 to 800	200
	Pn10D	Mode Switch Speed Reference	min^{-1}	0 to 10,000	0
	Pn10E	Mode Switch Acceleration	10 min^{-1}/s	0 to 3,000	0
	Pn10F	Mode Switch Error Pulse	Reference units	0 to 10,000	0
	Pn110	Online Autotuning Switches *3	---	---	0010
	Pn111	Speed Feedback Compensation *2	%	1 to 500	100
	Pn112	Fixed parameters (Do not change.)	%	0 to 1,000	100
	Pn113		---	0 to 1,000	1,000
	Pn114		---	0 to 1,000	200
	Pn115		---	0 to 65,535	32
	Pn116		---	0 to 65,535	16
	Pn117		%	20 to 100	100
	Pn118		%	50 to 100	100

Table A.2 SERVOPACK Parameters (cont'd)

Category	Parameter	Name	Unit	Setting Range	Factory Setting
Gain Related Constants (Cont'd)	Pn119	Fixed parameters (Do not change.)	1/S	1 to 2,000	50
	Pn11A		0.1%	1 to 2,000	1,000
	Pn11B		Hz	1 to 150	50
	Pn11C		Hz	1 to 150	70
	Pn11D		%	0 to 150	100
	Pn11E		%	0 to 150	100
	Pn11F		ms	0 to 2,000	0
	Pn120		0.01 ms	0 to 51,200	0
	Pn121		Hz	10 to 250	50
	Pn122		Hz	0 to 250	0
	Pn123		%	0 to 100	0
Position Related Constants	Pn200	Position Control Reference Selection Switches *3	---	---	0000
	Pn201	PG Divider *3	p/r	16 to 16,384	16,384
	Pn202	Electronic Gear Ratio (Numerator) *3	---	1 to 65,535	4
	Pn203	Electronic Gear Ratio (Denominator) *3	---	1 to 65,535	1
	Pn204	Not used.	---	---	0
	Pn205	Multiturn Limit Setting *1, *3	rev	0 to 65,535	65,535
	Pn206	Fixed parameter (Do not change.)	P/rev	513 to 65,535	16,384
	Pn207	Position Control Function Switches *3	---	---	0001
	Pn208	Position Reference Movement Averaging Time *3	0.01 ms	0 to 6,400	0
Speed Related Constants	Pn300	Not used.	---	---	600
	Pn301	Not used.	---	---	100
	Pn302	Not used.	---	---	200
	Pn303	Not used.	---	---	300
	Pn304	Jog Speed	min^{-1}	0 to 10,000	500
	Pn305	Soft Start Acceleration Time	ms	0 to 10,000	0
	Pn306	Soft Start Deceleration Time	ms	0 to 10,000	0
	Pn307	Not used.	---	---	40
	Pn308	Speed Feed-forward Filter Time Constant	0.01 ms	0 to 65,535	0

Table A.2 SERVOPACK Parameters (cont'd)

Category	Parameter	Name	Unit	Setting Range	Factory Setting
Torque Related Constants	Pn400	Not used.	---	---	30
	Pn401	Torque Reference Filter Time Constant	0.01 ms	0 to 65,535	100
	Pn402	Forward Torque Limit	%	0 to 800	800
	Pn403	Reverse Torque Limit	%	0 to 800	800
	Pn404	Not used.	---	---	100
	Pn405	Not used.	---	---	100
	Pn406	Not used.	---	---	800
	Pn407	Not used.	---	---	10,000
	Pn408	Torque Function Switches	---	---	0000
	Pn409	Notch Filter Frequency	Hz	50 to 2,000	2,000
Sequence Related Constants	Pn500	Not used.	---	---	7
	Pn501	Not used.	---	---	10
	Pn502	Rotation Detection Level	min^{-1}	1 to 10,000	20
	Pn503	Not used.	---	---	10
	Pn504	Not used.	---	---	7
	Pn505	Overflow Level	256 reference units	1 to 32,767	1,024
	Pn506	Brake Reference Servo OFF Delay Time	10 ms	0 to 50	0
	Pn507	Brake Reference Output Speed Level	min^{-1}	0 to 10,000	100
	Pn508	Timing for Brake Reference Output during Motor Operation	10 ms	10 to 100	50
	Pn509	Momentary Hold Time	ms	20 to 1,000	20
	Pn50A	Fixed parameters (Do not change.)	---	---	8881
	Pn50B		---	---	8888
	Pn50C		---	---	8888
	Pn50D		---	---	8888
	Pn50E		---	---	3000
	Pn50F		---	---	1200
	Pn510		---	---	0000
	Pn511		---	---	8468
	Pn512		---	---	0000
Other Constants	Pn600	Regenerative Resistor Capacity *4	10 W	0 to capacity*5	0
	Pn601	Fixed parameter (Do not change.)	---	0 to capacity*5	0

* 1. The multiturn limit must be changed only for special applications. Changing this limit inappropriate or unintentionally can be dangerous.
* 2. The setting of parameter Pn111 is valid only when parameter Pn110.1 is set to 0.
* 3. After changing these parameters, turn OFF the main circuit and control power supplies and then turn them ON again to enable the new settings. (Pn110.1 and Pn110.2 are on-line parameters and become effective immediately.)
* 4. Normally set to "0". When using an External Regenerative Resistor, set the capacity (W) of

the regenerative resistor.

* 5. The upper limit is the maximum output capacity (W) of the SERVOPACK.

A.3 SERVOPACK Switches

The following table shows the SERVOPACK's software switches.

Table A.3 SERVOPACK Switches

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn000 Function Selection Basic Switches	0	Direction Selection	0	Sets CCW as forward direction.	0
			1	Sets CW as forward direction (reverse rotation mode).	
	1	Control Method Selection	1	Position control	1 (fixed)
	2	Axis Address	0 to F	Sets SERVOPACK axis address (rotary switch (ADRS))	0
	3	Reserved	---	---	0
Pn001 Function Selection Application Switches	0	Servo OFF or Alarm Stop Mode	0	Stops the motor by applying dynamic brake (DB).	0
			1	Stops the motor by applying dynamic brake (DB) and then releases DB.	
			2	Makes the motor coast to a stop state without using the dynamic brake (DB).	
	1	Not used.	---	---	0
	2	AC/DC Power Input Selection	0	Not applicable to DC power input: Input AC power supply through L1, L2, and (L3) terminals.	0
			1	Applicable to DC power input: Input DC power supply through (+)1 and (-) terminals.	
	3	Warning Code Output Selection	0	ALO1, ALO2, and ALO3 output only alarm codes.	0
			1	ALO1, ALO2, and ALO3 output both alarm codes and warning codes. While warning codes are output, ALM signal output remains ON (normal state).	
Pn002 Function Selection Application Switches	0	Not used.	---	---	0 (fixed)
	1	Not used.	---	---	0
	2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder.	0
			1	Uses absolute encoder as an incremental encoder.	
	3	Not used.	0 to 4	---	0 (fixed)

Table A.3 SERVOPACK Switches (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn003 Function Selection Application Switches	0	Analog Monitor 1 Torque Reference Monitor	0	Motor speed: 1 V/1000 min^{-1}	2
			1	Internal speed reference: 1 V/1000 min^{-1}	
			2	Internal torque reference: 1 V/100%	
	1	Analog Monitor 2 Speed Reference Monitor	3	Position error: 0.05 V/1 reference unit	0
			4	Position error: 0.05 V/100 reference units	
			5	Position reference speed (converted to min^{-1}): 1 V/1000 min^{-1}	
			6	Motor speed × 4: 1 V/250 min^{-1}	
			7	Motor speed × 8: 1 V/125 min^{-1}	
			8	Fixed parameters (Do not change.)	
			9		
			A		
			B		
			C		
			D		
			E		
			F		
	2	Reserved	---	---	0
	3	Reserved	---	---	0
Pn10B	0	Mode Switch Selection	0	Uses internal torque reference as the condition (Level setting: Pn10C)	0
			1	Uses speed reference as the condition (Level setting: Pn10D)	
			2	Uses acceleration as the condition (Level setting: Pn10E)	
			3	Uses error pulse as the condition (Level setting: Pn10F)	
			4	No mode switch function available	
	1	Speed Loop Control Method	0	PI control	0
			1	IP control	
	2	Reserved	0	---	0
	3	Fixed parameter (Do not change.)	0 to 2	---	0

Table A.3 SERVOPACK Switches (cont'd)

Parameter	Digit Place	Name	Setting	Contents	Factory Setting
Pn110 Online Autotuning Switches	0	Online Autotuning Method	0	Tunes only at the beginning of operation.	0
			1	Always tunes.	
			2	Does not perform autotuning.	
	1	Speed Feedback Compensation Selection	0	Enabled	1
			1	Disabled	
	2	Friction Compensation Selection	0	Friction compensation: Disabled	0
			1	Friction compensation: Small	
			2	Friction compensation: Large	
	3	Fixed parameter (Do not change.)	0 to 3	---	0
Pn200 Position Control References Selection Switches	0	Not used.	---	---	0
	1	Not used.	---	---	0
	2	Clear Operation	0	Clears error counter at the baseblock.	0 (fixed)
			2	Clears error counter when an alarm occurs.	
	3	Not used.	---	---	0
Pn207 Position Control Function Switches	0	Position Reference Filter Selection	1	S curve	1 (fixed)
	1	Not used.	---	---	0
	2	Reserved	---	---	0
	3	Reserved	---	---	0
Pn408 Torque Function Switches	0	Notch Filter Selection	0	Disabled.	0
			1	Uses a notch filter for torque reference.	
	1	Reserved	---	---	0
	2	Reserved	---	---	0
	3	Reserved	---	---	0

Appendix B

Monitor Mode and Auxiliary Functions

This appendix provides lists of monitor modes and auxiliary functions that can be used when the Digital Operator is connected to connector CN7.

B.1 Monitor Modes - - -

B.1 Monitor Modes

The following table shows the monitor modes that can be used when the Digital Operator is connected to connector CN7.

Table B.1 Monitor Modes

Monitor Number	Display Contents	Unit	Serial Command
Un000	Actual motor speed	min^{-1}	NFB
Un001	Not used.	---	---
Un002	Internal torque reference *1	%	TREF
Un003	Rotation angle (pulses) *2	pulse	---
Un004	Rotation angle (electrical angle)	deg	---
Un005	SERVOPACK (CN1) input signal monitor	---	IN1
Un006	SERVOPACK (CN1) output signal monitor	---	OUT1
Un007	Position reference speed	min^{-1}	NREF
Un008	Position error	reference units	PER
Un009	Torque load ratio monitor*3	%	TRMS
Un00A	Regeneration load ratio monitor*4	%	RGRMS
Un00B	Dynamic-brake load ratio monitor*5	%	DBRMS
Un00C	Position reference pulse counter (hexadecimal)*6	reference units	---
Un00D	Encoder pulse counter (hexadecimal)*6	pulse	---
Un800	Last Error (Most Recent Error Code)	---	ERR
Un801	NS600 (CN4) input signal monitor	---	IN2
Un802	NS600 (CN4) output signal monitor	---	OUT2
Un803	Status flag monitor	---	STS
Un804	Current position reference monitor	reference units	PUN
Un805	Current motor position monitor	reference units	PFB
Un806	Target position monitor	reference units	POS
Un807	Target distance monitor	reference units	DST
Un808	Registration target position monitor	reference units	RPOS
Un809	Registration distance monitor	reference units	RDST
Un80A	Program step (PGMSTEP) monitor	---	PGMSTEP
Un80B	Program event time progress monitor	ms	EVTIME
Un80C	Program loop progress monitor	repetitions	LOOP
Un80D	Serial command received character trace	---	---
Un80E	Serial command received character count	---	---
Un80F	Serial command received error character count	---	---
Un810	Serial command transmitted character trace	---	---
Un811	Serial command transmitted character count	---	---

* 1. Indicates the percentage of the rated torque. (100% is the rated torque.)
* 2. Indicates the number of pulses from the encoder's phase C.
* 3. Indicates the percentage of the rated torque over a 10 second period.

* 4. Indicates the percentage of the maximum regenerative power over a 10 second period.
* 5. Indicates the percentage of the maximum DB power consumption over a 10 second period.
* 6. These values are expressed in hexadecimal.

B.2 Auxiliary Functions

The following table shows the auxiliary functions that can be used when the Digital Operator is connected to connector CN7.

Table B.2 Usable Auxiliary Functions

Monitor Number	Function	Serial Command
Fn000	Alarm traceback data display	ALM0 to ALM9
Fn001	Rigidity setting during online autotuning	STIFF, STIFFd
Fn002	JOG mode operation	---
Fn003	Zero-point search	---
Fn004	Not used.	---
Fn005	Parameter settings initialization	PRMINIT
Fn006	Alarm traceback data clear	ALMTRCCLR
Fn007	Writing to EEPROM inertia ratio data obtained from online autotuning	INERTIA, TUNESTORE
Fn008	Absolute encoder reset	ABSPGRES
Fn009	Not used.	---
Fn00A	Not used.	---
Fn00B	Not used.	---
Fn00C	Manual zero-adjustment of analog monitor output	---
Fn00D	Manual gain-adjustment of analog monitor output	---
Fn00E	Automatic offset-adjustment of motor current detection signal	CURZERO
Fn00F	Manual offset-adjustment of motor current detection signal	---
Fn010	Write-protection setting	---
Fn011	Motor models display	MTTYPE, MTSIZE, PGTYPE, SVYSPEC
Fn012	SERVOPACK software version display	SVVER, PGVER
Fn013	Multiturn limit value setting change when a Multiturn Limit Disagreement Alarm (A.CC) occurs	MLTLIMSET
Fn014	Not used.	---
Fn800	NS600 software version display	VER
Fn801	NS600 model code (0600 Hex) display	TYPE
Fn802	NS600 Y spec. number display	YSPEC
Fn803	Program table save	PGMSTORE
Fn804	Zone table save	ZONESTORE
Fn805	Jog speed table save	JSPDSTORE
Fn806	Program table initialization	PGMINIT
Fn807	Zone table initialization	ZONEINIT
Fn808	Jog speed table initialization	JSPDINIT

Appendix C

List of Serial Commands

This appendix provides a list of the serial commands in alphabetical order.

C.1 Alphabetical List of Serial Commands - - - - - - - - - - - - - - - - C-2

C.1 Alphabetical List of Serial Commands

The following table lists the usable serial commands in alphabetical order.
For more details on the serial commands, see *6.7 Serial Commands*.

Table C.1 Alphabetical List of Serial Commands

Serial Command	Function	Reference
ABSPGRES	Absolute Encoder Reset	6.7.8
ACCnnnnnnnn	Acceleration Reservation	6.7.2
ALM	Alarm or Warning Read	6.7.8
ALMn	Alarm History Read	6.7.8
ALMTRCCLR	Alarm Trace Clear	6.7.8
ARES	Alarm Reset	6.7.1
CURZERO	Motor Current Zero Adjustment	6.7.8
DBRMS	Dynamic-Brake Load Ratio Monitor	6.7.8
DECnnnnnnnn	Deceleration Reservation	6.7.2
DST or MON9	Target Distance Monitor	6.7.8
ERR	Most Recent Error Read	6.7.8
EVENTTsss	Program Table EVENT Read	6.7.4
EVENTsss=	Program Table EVENT Write	6.7.4
EVTIME	Program EVENT Elapsed Time Monitor	6.7.8
HOLD	Positioning Interruption (or Jog Stop)	6.7.2
IN1	SGDH Input Signal Monitor (CN1)	6.7.8
IN2	NS600 Input Signal Monitor (CN4)	6.7.8
IN2TESTbbbbbbbb	NS600 Input Signal Reservation (CN4)	6.7.8
INERTIA	Auto-tuning Inertia Display	6.7.8
JOGPnnnnnnnn	Motor Forward	6.7.2
JOGNnnnnnnnn	Motor Reverse	6.7.2
JSPDINIT	JOG Speed Table Initialization	6.7.7
JSPDSTORE	JOG Speed Table Save	6.7.7
JSPDTdd	JOG Speed Table JSPD (jog speed reservation) Read	6.7.7
JSPDTdd=	JOG Speed Table Write	6.7.7
LOOP	Program LOOP Pass Through Monitor	6.7.8
LOOPTsss	Program Table LOOP Read	6.7.4
LOOPTsss=	Program Table LOOP Write	6.7.4
MLTLIMSET	Multiturn Limit Setting	6.7.8
MONn	Monitor Read	6.7.8
MTSIZE	Monitor Capacity Display	6.7.8
MTTYPE	Motor Type Display	6.7.8
NEXTTsss	Program Table NEXT Read	6.7.4
NEXTTsss=	Program Table NEXT Write	6.7.4
NFB or MON3	Motor Speed Monitor	6.7.8
NREF or MON4	Speed Reference Monitor	6.7.8

Table C.1 Alphabetical List of Serial Commands (cont'd)

Serial Command	Function	Reference
OUT1	SGDH Output Signal Monitor (CN1)	6.7.8
OUT2	NS600 Output Signal Monitor (CN4)	6.7.8
OUT2TESTbbbbbb	NS600 Output Signal Reservation (CN4)	6.7.8
PER or MON2	Position Error Monitor	6.7.8
PFB or MON7	Current (actual) Motor Position Monitor	6.7.8
PGMINIT	Program Initialization	6.7.4
PGMRES	Program Table Operation Reset	6.7.5
PGMSTEP	Program PGMSTEP Pass Through Monitor	6.7.8
PGMSTORE	Program Table Save	6.7.4
PGTYPE	Encoder Type Display	6.7.8
PGVER	Encoder Firmware Version Display	6.7.8
POS (±) nnnnnnnn POSA (±) nnnnnnnn	Target Position Reservation (Absolute Position)	6.7.2
POS or MON8	Target Position Monitor	6.7.8
POSI (±) nnnnnnnn	Target Position Reservation (Relative Position)	6.7.2
POSTsss	Program Table POS Read	6.7.4
POSTsss=	Program Table POS Write	6.7.4
POUT	POUT Monitor	6.7.8
POUTnnnnn	POUT Reservation	6.7.2
POUTTsss	Program Table POUT Read	6.7.4
POUTTsss=	Program Table POUT Write	6.7.4
PRMINIT	Parameter Initialization	6.7.3
PRMppp	Parameter Read	6.7.3
PRMppp=	Parameter Write	6.7.3
PUN or MON1	Current Distributed Position Monitor	6.7.8
RDST or MON11	Registration Target Distance Monitor	6.7.8
RDSTnnnnnnnn	Registration Distance Reservation	6.7.2
RDSTTsss	Program Table RDST Read	6.7.4
RDSTTsss=	Program Table RDST Write	6.7.4
RES	Reset	6.7.1
RGRMS	Regeneration Load Ratio Monitor	6.7.8
RPOS or MON10	Registration Target Position Monitor	6.7.8
RS	Positioning Start with Registration	6.7.2
RS (±) nnnnnnnn RSA (±) nnnnnnnn	Positioning Start with Registration (Absolute Position)	6.7.2
RSI (±) nnnnnnnn	Positioning Start with Registration (Relative Distance)	6.7.2
RSPDnnnnnnnn	Registration Speed Reservation	6.7.2
RSPDTsss	Program Table RSPD Read	6.7.4
RSPDTsss=	Program Table RSPD Write	6.7.4
SKIP	Positioning Stop (or Jog Stop)	6.7.2
SPDnnnnnnnn	Positioning Speed Reservation	6.7.2

Table C.1 Alphabetical List of Serial Commands (cont'd)

Serial Command	Function	Reference
SPDTsss	Program Table SPD Read	6.7.4
SPDTsss=	Program Table SPD Write	6.7.4
ST	Positioning Start	6.7.2
ST (±) nnnnnnnn STA (±) nnnnnnnn	Positioning Start (Absolute Position)	6.7.2
START	Program Table Operation Restart	6.7.5
STARTsss	Program Table Operation Start	6.7.5
STI (±) nnnnnnnn	Positioning Start (Relative Position)	6.7.2
STIFF	Rigidity Monitor	6.7.8
STIFFd	Rigidity Reservation	6.7.8
STOP	Program Table Operation Interruption	6.7.5
STS or MON6	Status Flag Monitor [reference units]	6.7.8
SVOFF	Servo OFF	6.7.1
SVON	Servo ON	6.7.1
SVTYPE	SGDH Type Code (xx02H) Display	6.7.8
SVVER	SGDH Firmware Version Display	6.7.8
SVYSPEC	SGDH Y Spec. No. Display	6.7.8
TREF or MON5	Torque Reference Monitor	6.7.8
TRMppp=	Temporary Parameter Write	6.7.3
TRMS	Torque Load Ratio Monitor	6.7.8
TUNESTORE	Auto-tuning Inertia Save	6.7.8
TYPE	NS600 Type Code (0600H) Display	6.7.8
VER	NS600 Firmware Version Display	6.7.8
YSPEC	NS600 Y Spec. No. Display	6.7.8
ZONEINIT	Zone Table Initialization	6.7.6
ZONENTzz	Zone Table ZONEN (negative side zone position limit) Read	6.7.6
ZONENTzz=	Zone Table ZONEN (negative side zone position limit) Write	6.7.6
ZONEPTzz	Zone table ZONEP (positive side zone position limit) Read	6.7.6
ZONEPTzz=	Zone Table ZONEP (positive side zone position limit) Write	6.7.6
ZONESTORE	Zone Table Save	6.7.6
ZRN	Homing Start	6.7.2
ZSET (±) nnnnnnnn	Coordinates Setting	6.7.2

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Symbols

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